the OIL AND GAS JOURNAL
PUBLISHED WEEKLY JULY 17, 1961

New pattern for Libyan operations may be set ▸ 41

Rojo Caballos field—nothing but "million dollar wells" ▸ 44

World's first septuple completion planned ▸ 61

Regular vessel inspection pays off for Phillips ▸ 90

Gravity-magnetics can be an effective oil-finding tool ▸ 126

Special report

WERTZ FIELD

After 20 years of pressure maintenance

p. 76

MORE PROGRESS from HALLIBURTON

THE NEW DESIGN FOR FRACTURING WELLS

Halliburton's new FRACPLAN procedure enables you to *pre*plan a specific fracturing treatment. This preplanning can pay off in greater flow capacity of the fractured formation—resulting in greater productivity.

Through the results of many contributing research and development studies, this *advanced* way of production stimulation was achieved. Halliburton is proud to offer FRACPLAN's benefits to the petroleum producing industry.

Maintaining leadership in oilfield services is a dual promise at Halliburton. We have pledged it to you . . . and to ourselves.

Halliburton COMPANY
DUNCAN, OKLAHOMA

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Vol. 59, No. 29

Contents July 17, 1961

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TECHNOLOGY—OPERATION

Drilling-Production

Wertz Field After 20 Years of Pressure Maintenance 76

By Neil Williams

Pressure-maintenance operations as carried out by Sinclair Oil & Gas Co. in its Wertz, Wyoming, field are paying off as planned. This not only means greatly increased oil recovery, but also getting it in much shorter time than otherwise would be possible.

Slim Holes Can Cut Hard-Rock Drilling Cost 81

By Frank M. Pool

Field tests made by a drilling contractor show that the slim hole is not just a soft-rock method. It can save money in tougher drilling like West Texas and New Mexico.

Cut Costs by Stopping Failures in Running Casing 92

By Neil C. Owens

Many costly failures can be prevented by good supervision. A good example is in running casing strings. Here's a review of some of the most important details which can easily make the difference between success and failure in a well completion.

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By E. T. Guerrero

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Oil-Well Pumping—48 98

By Joseph Zaba

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Here are 15 Tips on Protecting Pipelines 102

By Leo J. Crowder

This check list covers the most commonly neglected areas on a pipeline job.

Refining-Processing

How process Analyzers Compare with Laboratory Instruments 69

By Conrad K. Donnell and Martin W. Luther

With one exception all of the readings from the six analyzers were more consistent than laboratory results on standard samples. Three of the analyzers gave outstanding results.

Processing Notes 86

New weigh cell facilitates pilot-plant automation—Copolymer becomes country's fourth-largest SBR plant—Esso patents bacterial desulfurization method.

Regular Vessel Inspection Pays Off 90

By V. J. Whitehorn

Phillips Petroleum Co. is reducing the hazard caused by leaks and failure of process vessels by a periodic internal vessel-inspection program in its natural-gasoline plants.

Process Costimating—98 99

Summary of light-oil-treating operating costs.

THE OIL AND GAS JOURNAL **Newsletter**

July 17, 1961

Significant this week

Completely new pattern for oil operations in Libya may be in the works.

Tipoff on this comes from recent formation of new entry in country's oil sweepstakes. Venture is called National Oil Co. of Libya. American and European cooperatives are backing it, and there's little doubt that it has support of Libyan Government.

It's believed several Libyan bigwigs have a role in new company, but no details have been announced.

If this firm acquires Libyan oil concessions, it could mean government may insist that any applicant for exploration acreage in the future must take on Libyan partners (p. 41).

There'll be spectacular growth in U. S. energy needs during the next 20 years.

That conclusion highlights a new economic study by Texas Eastern Transmission on domestic fuels.

Some forecasts for 1980:

...Petroleum and gas will still dominate supply scene.

...Demand for petroleum will equal 15,261,000 bbl. daily while natural-gas consumption will top 23 trillion cubic feet a day (p. 46).

In prospect: A test of just how binding area-price guidelines are on natural-gas sale contracts.

FPC Examiner Robert M. Weston has approved a contract price higher than area price suggested by commission. Case involves Shell sale of gas from Elk City field in Oklahoma to Panhandle Eastern Pipe Line.

If commission upholds Weston in review of decision, it will be another stride toward value concept of gas regulation rather than utility-type approach tied to costs (p. 54).

Worsley gas field in Alberta shows glowing promise.

Estimated reserves of 300 billion cubic feet in northernmost D-3 reef development of province may be tripled.

So says Westcoast Transmission in seeking authority to export gas from Worsley area through $2.5-million pipeline mapped by Alberta Gas Trunk Line (p. 48).

Texas well may turn out to be septuple producer.

If Texaco's 1 D. V. McIntosh in thriving Blessing field, Matagorda County, is installed according to plan it will be

world's first well to produce simultaneously from seven pay zones. Railroad Commission has been asked to issue permit.

Texaco plans to complete well to produce from two oil pays and five gas zones between 7,020 and 8,553 ft. (p. 61).

Sinclair's pressure-maintenance program in Wertz field, Wyoming, has scored a big success in the past 20 years.

Back in 1943, just 2½ years after the first gas was injected into the field's main Tensleep reservoir, the Journal carried a rundown on how things were going. Associate Editor Neil Williams wrote the piece.

When it was decided recently that a "20 years after" story on the field would be a good idea, there was no doubt about which editor should be assigned to the job.

Williams' comprehensive followup starts on p. 76.

Talk about million-dollar wells!

It costs that much or more to drill one in Rojo Caballos gas-distillate field of West Texas. Mobil spent over $5 million drilling just three completions in the prolific but aggravating field.

Reason for the staggering expense: In addition to West Texas hard rock, operators have to cope with severe lost circulation and extremely high pressure.

To help cushion such financial blasts, Mobil's applying for widest spacing ever sought in Texas (p. 44).

In overseas developments:

Construction of a second Central Europe pipeline is being weighed by ENI's Enrico Mattei.

Work is already underway on Mattei's first big weapon in his fight with private companies for Swiss, Bavarian, and Austrian markets. This is a 625-mile crude line from Genoa to Switzerland and Germany.

Mattei says Trieste-Austria line could be supported by crude from ENI's major oil field in Persian Gulf off Iran (p. 65).

News in the making

Here is the outlook for a fuels study:

New resolution will be offered by Senate Interior Committee. It'll be briefer and more general than original one.

This substitute will call for a special subcommittee chosen from parent Interior Committee to make the study. The scope will include energy requirements, current and predicted fuel supplies, and how consumers are affected.

Committee's proposal should win approval on Senate floor when it is made.

Arizona legislature may be asked to okay a $200,000 oil bonus.

State Oil and Gas Conservation Commission backs such an award for discovery of first commercial oil or natural gas outside Indian reservations. Marshall Simms, a state senator, says he'll ask Arizona Legislative Council to draft bonus bill and determine whether it would be constitutional.

BP Canada is arranging export of 1,000 bbl. daily of Alberta crude to Sohio in Toledo, starting next month.

Sale is linked to Canadian Government's request for Montreal refiners to find new markets for Canadian output in return for import privileges. BP Canada runs about 18,000 bbl. daily of Kuwait crude in its Montreal refinery.

U. S. rotary rig activity continues to climb.

Latest figures show that 1,836 rigs were operating during week that ended July 10. Total was 30 higher than week before, and marked highest level of the year.

Town-lot drillers may step up activities in Los Angeles.

Standard of California has lease play in Van Nuys—and Mobil, Continental, Richfield, Signal, and Union also have town-lot plans in the mill. Chances are good that at least three town-lot wildcats, and possibly six, will be drilled within next year.

A new proposal would send rental for pipeline right of way on public lands into orbit.

It would jump the fee from $5 a mile to $5 an acre—an 1,100% increase. Under current Bureau of Land Management rules, it costs a pipeliner only $50 a year for a 50-ft. right of way covering 10 miles. But if the proposal is approved, rental would be $595. Pipeliners have until July 27 to protest the move.

First of two underwater gas lines across troublesome Turnagain Arm has been laid by Alaska Pipeline.

Viscous bottom and 30-ft. tides prevented scheduled laying of 12-in. line last fall. Second line is expected to be finished next month, completing 74-mile Kenai-Anchorage transmission system.

Look for steel prices to go up this fall.

Autumn business pickup is expected to embolden steel producers. Educated guess calls for average increase of $4 to $5 a ton in base prices of selcted forms. Time: Near the start of October.

Market memo

July 17, 1961

Offseason strength of No. 2 on the Gulf and weak spots in several areas for gasoline feature the markets. The trends may presage price changes.

A major purchaser reportedly has taken three T-2 cargoes of No. 2 from Gulf Coast independent refiners for prompt lifting to the East Coast. Price paid was believed one-fourth cent off the low posting of 8.25 cents per gallon.

The purchase, which followed a similar order several weeks ago by same buyer, has nearly dried up No. 2 spot supplies on the gulf and tightened further discounts. In fact, new quotes started at one-fourth cent over postings and led to talk of a contraseasonal price advance.

Back of the price pressure is realization that end of the 80-day cooling off period when maritime workers may strike again comes at start of heating-oil season. Strong movement of distillates in the interim may emerge as a hedge against a shortage then.

Gasoline postings aren't being tested on the gulf. Talk in the trade is that firm buying order of cargo size could bring out discounts of one-half cent off all grades. Suppliers on the gulf, however, are holding No. 6 for a 10-cent increase to $2.30 per barrel.

Discounting of gasoline is becoming more prevalent in northern part of Mid-Continent, reaching as far south as Des Moines. Jobbers are hearing some quotations of 11.75 to 12 cents. In other areas, normal one-fourth cent discounting off 12.50-cent posting is common.

River markets are described as inactive with few spot sales. Chicago is quiet, called more stable than for weeks. East Coast, except for Charlotte area, also is steady.

Crude notes: Gulf has ended its proration on buying in Texas, Louisiana Delta, and New Mexico, imposed when the maritime strike started . . . Pure has cut 7,500 bbl. daily off its purchases in the Denver-Julesburg basin for July . . . Great Northern has increased price for medium gravity Saskatchewan crude by 1 and 2 cents . . . Production in California last month slipped to 817,500 bbl. daily, lowest since early 1944.

Gulf is battling independent marketers on their own ground in San Antonio experiment. It is offering new economy brand gasoline, Gulftane, at same price posted by independents. Outcome of the fight may set some new marketing patterns for growing fight for markets (p. 42).

Other marketing developments: The 1-cent spread between independent and major gasoline prices in Los Angeles has sprung a leak or two. Several spots have reverted to traditional 2-cent margin . . . Sinclair has won decision in Florida that its guaranteed margin to dealers during price wars does not violate antitrust . . . Phillips has expanded into New Jersey by signing up Consumers Oil Corp. of Trenton with 30 stations . . . Sun is offering customers a choice of credit plans—new plastic credit cards or the old Sunchex system.

Serving the HEART of the Petroleum Industry

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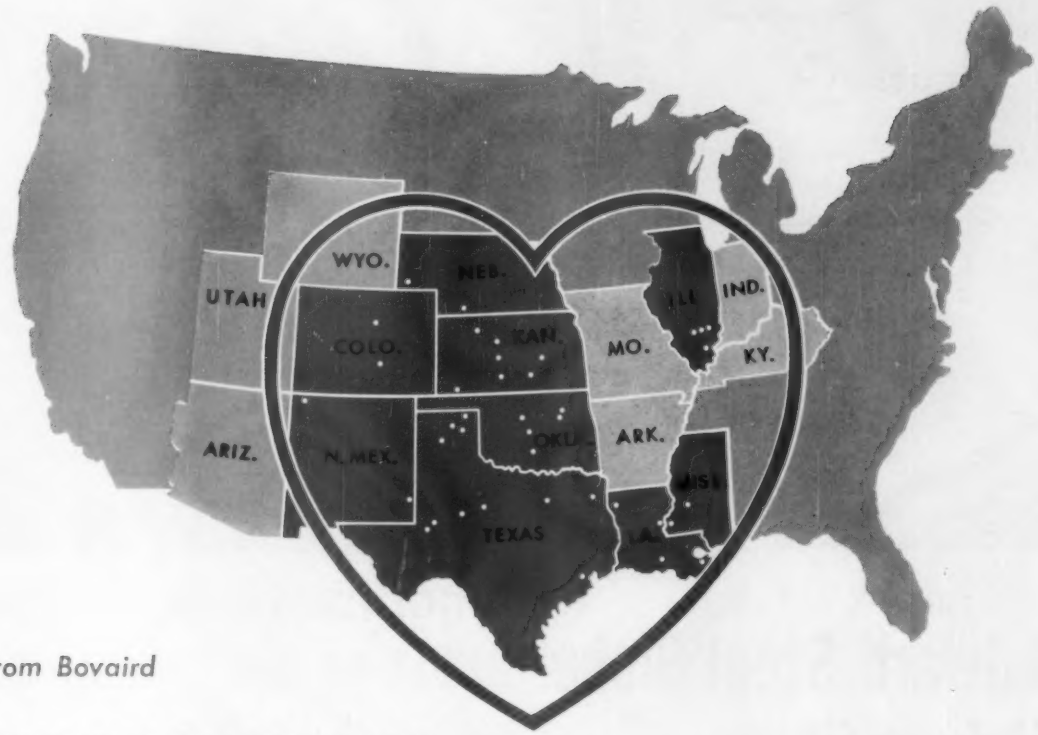

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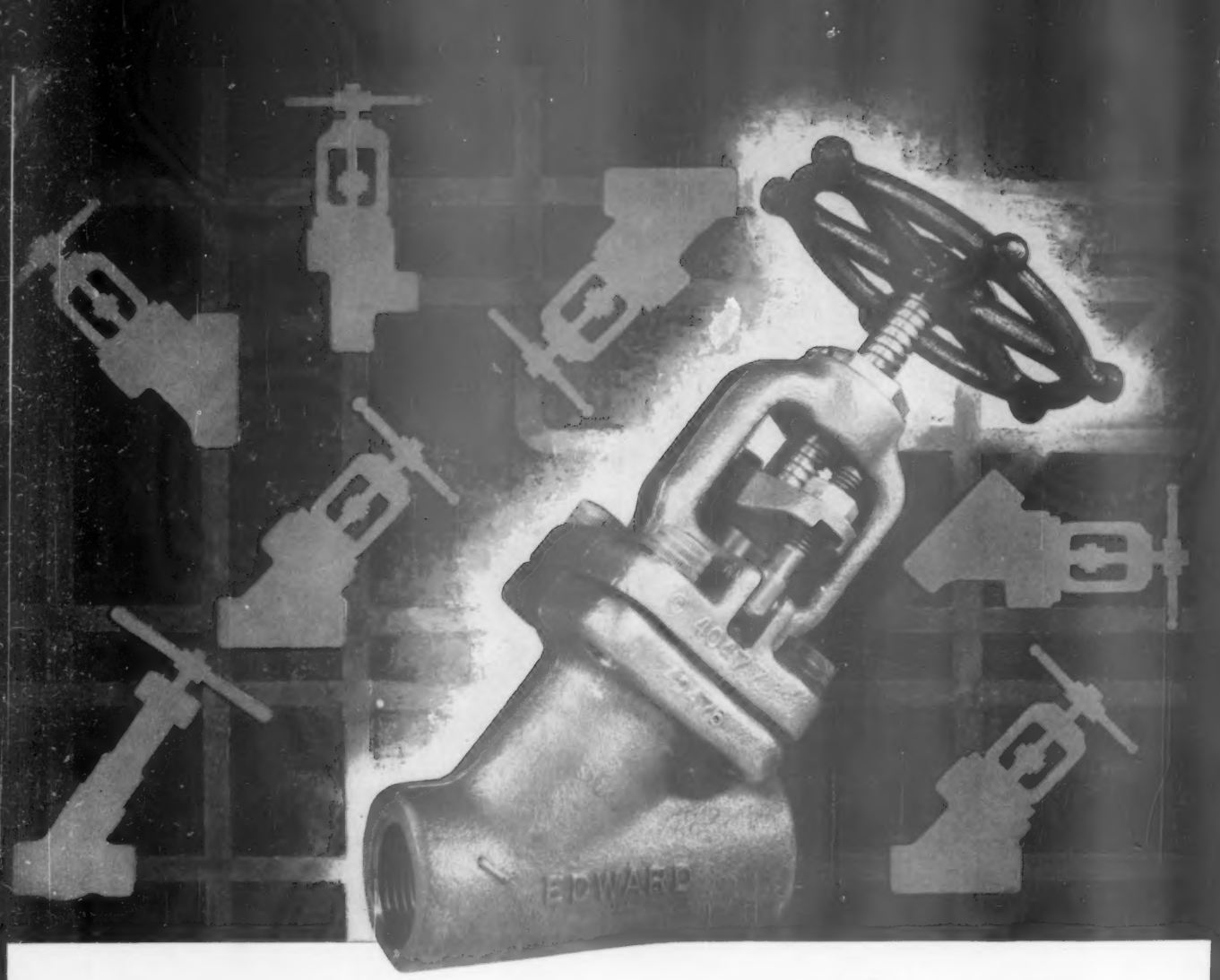
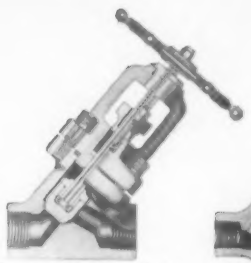
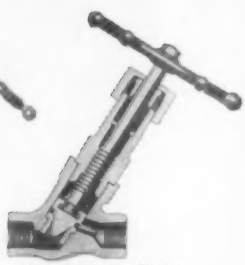


Edward Steel Globe Valves fit any oilfield or refinery piping plan

Edward forged steel globe and angle valves are perfectly designed for oilfield, petrochemical, and refinery applications. Ideal for air, water, oil, and other hydrocarbons, for steam, anhydrous ammonia and other gases . . . they resist corrosion, heat, high pressure, abrasion, and rough treatment from operators. They are available in sizes from ¼" to 2½", in both globe and angle designs, to suit any petroleum industry application. Edward globe valves feature straightway design for optimum flow, Impactor* handles for easy seating in high-pressure service, and other innovations developed in Edward's uniquely large research laboratories. Edward builds a complete line of forged and cast steel stop, check, and stop-check valves for process industries. For additional information, see your favorite distributor, or write to Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company. 6015



General Purpose Globe Valve
Fig. 848, Bolted Bonnet
2000 lb WOG
600 lb at 910F
(Sizes ¼" to 1")



High Pressure Globe Valve
Fig. 158, Screwed Bonnet
10,000 lb WOG
(Sizes ¼" to 2")

Fig. 848 features new spiral wound gasket, new solid disk of chrome-cobalt-tungsten alloy, integral Stellite seat, forged steel body and bonnet, exclusive EValloy 13% chromium stainless steel stem, and new swing-style stainless steel gland bolts. Also available in angle design. Fig. 158 features EValized bonnet to resist corrosion and abrasion, and protect stem threads; replaceable screwed-in seat and swivel needle disk of EValloy 13% chromium stainless steel, Impactor* handle, Buna-N "O" rings for leakproof joints. Both valve types are available in choice of screwed or socket welding ends.

*T.M. Reg. U.S. Pat. Off.

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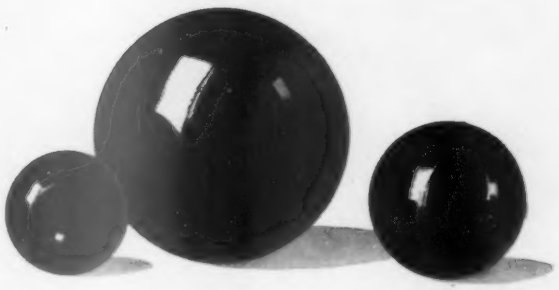
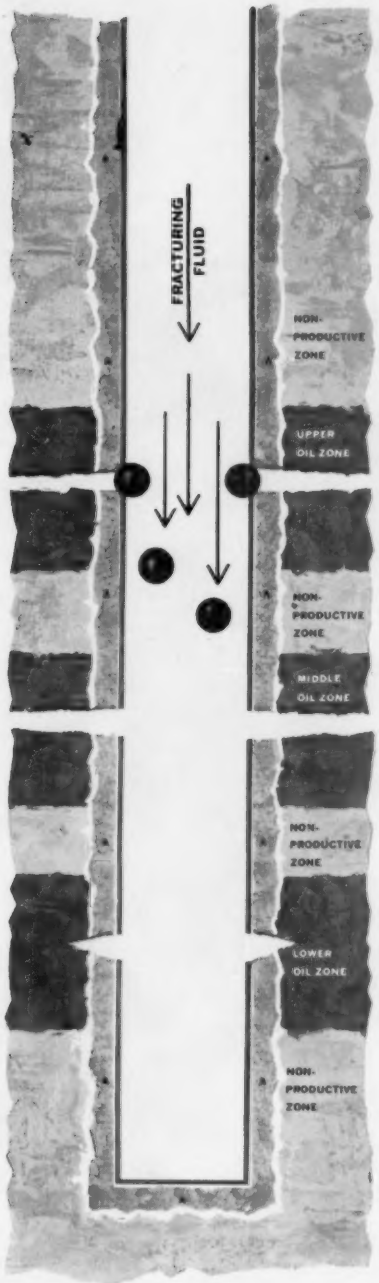
another fine product by
ROCKWELL

B.F.Goodrich





Ⓐ Sheath of set cement between pipe and wall of hole.

Halliburton Company, Duncan, Oklahoma, uses these balls for its fracturing operations. Balls are covered with Hycar by Oil States Rubber Company, Arlington, Texas. B.F.Goodrich Chemical Company supplies the Hycar rubber.

Well casing perforations sealed with balls of HYCAR

Each of these balls—nylon, covered with Hycar nitrile rubber—will form a seal within a well casing, closing off perforations that are taking fracturing fluid. The balls are injected onto the fluid stream, finding their own places as pressure forces them into holes in the casing. When pressure is relieved, balls fall to the well bottom or may be recovered by mechanical means.

The balls have a solid nylon center to keep them from extruding or squeezing through the slightly smaller holes under high pressure. Their Hycar cover gives them the necessary resilience under pressure and variable temperatures for a seal. Hycar also provides unusual resistance to attack by acidizing or fracturing solutions, as well as excellent extra abrasion resistance.

Here's another sample of the way Hycar provides resilience under the toughest oil-field conditions—of heat, pressure and corrosive influences. It will pay you to get more information about Hycar. Write Department MF-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

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Hycar

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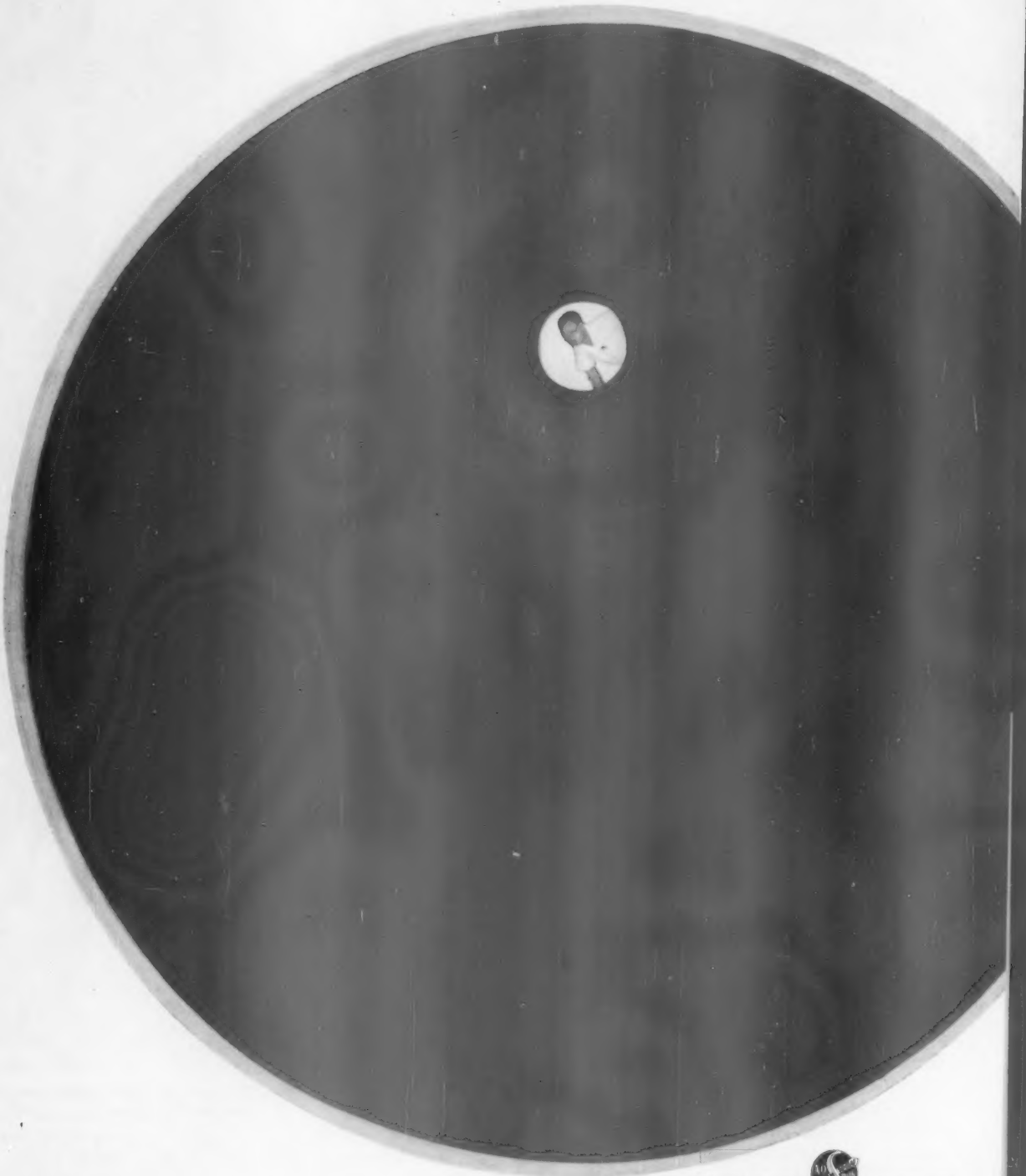

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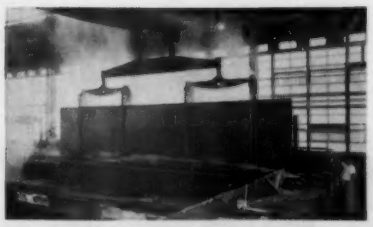


PICKLING—All plate for A. O. Smith pipe is pickled to remove rust and mill scale. The clean surface is preserved throughout the complete pipe-making process.

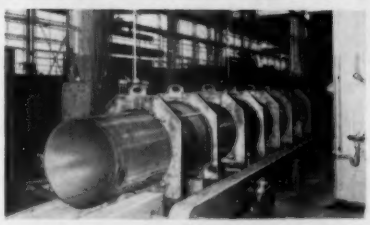
CLEANING — Wire brushing and scrubbing with a hot cleaning solution is the first step in the preparation of pipe for internal coating.

internal coating "a better way"

A. O. Smith Corporation believes that the best coating results are obtained from an originally clean, pickled surface, and that coating applied to such a surface will yield maximum benefits to the user. To this end A. O. Smith has established newly designed and fully enclosed facilities for *separate* cleaning and *separate* coating of 16″ through 36″ line pipe at both its Houston and Milwaukee plants.

These modern coating facilities are typical of A. O. Smith's ability to manufacture line pipe to exact customer specifications. For your exact coating requirements, contact the A. O. Smith sales office near you.

FLUSHING — Rotating pipe is thoroughly flushed with clean, hot water, leaving a clean, bright surface.



HEATING — Pipe is heated to a controlled level prior to the application of the internal coating.

SPRAYING — Airless spray equipment is used to apply the coating in a vented, dust-free enclosure.

CURING — Residual heat accelerates curing before pipe is exposed to weather.

NEW by CLARK

1000 bhp COMPRESSOR ON 35 ft SKID... COMPLETE!

It's called the Clark **VeePac** and you can see at a glance that here is the most compact, most versatile, most long-lived packaged compressor available today. Now you can have a unit up to 1000 bhp complete with radiator and all accessories mounted on a single skid only 35 feet long.

Designed For Field Service, offshore platforms and process use, the *VeePac* combines V-Engine compactness with the known reliability and simplicity inherent in Clark 2-Cycle design. The use of large blocks of horsepower in one package affords new savings in space, total units required, installation costs and operating expense.

Versatility is a key feature. Depending on the service, the *VeePac* can be equipped with compressor cylinders on one or both sides of the crankcase. For low suction pressure applications, as many as six large compressor cylinders can be used.

A Constant Pressure Turbocharger packs vast amounts of scavenging air into the combustion system, thereby boosting power output, reducing fuel consumption and lowering cooling duty. Completely automatic in operation, it tailors the air supply to engine demands over the entire operating range.

Variable-Speed, Variable-Load applications present no problem. An automatic ignition timing control combines with the turbocharger to provide exceptionally good response, good speed control, and low fuel consumption over a wide range.

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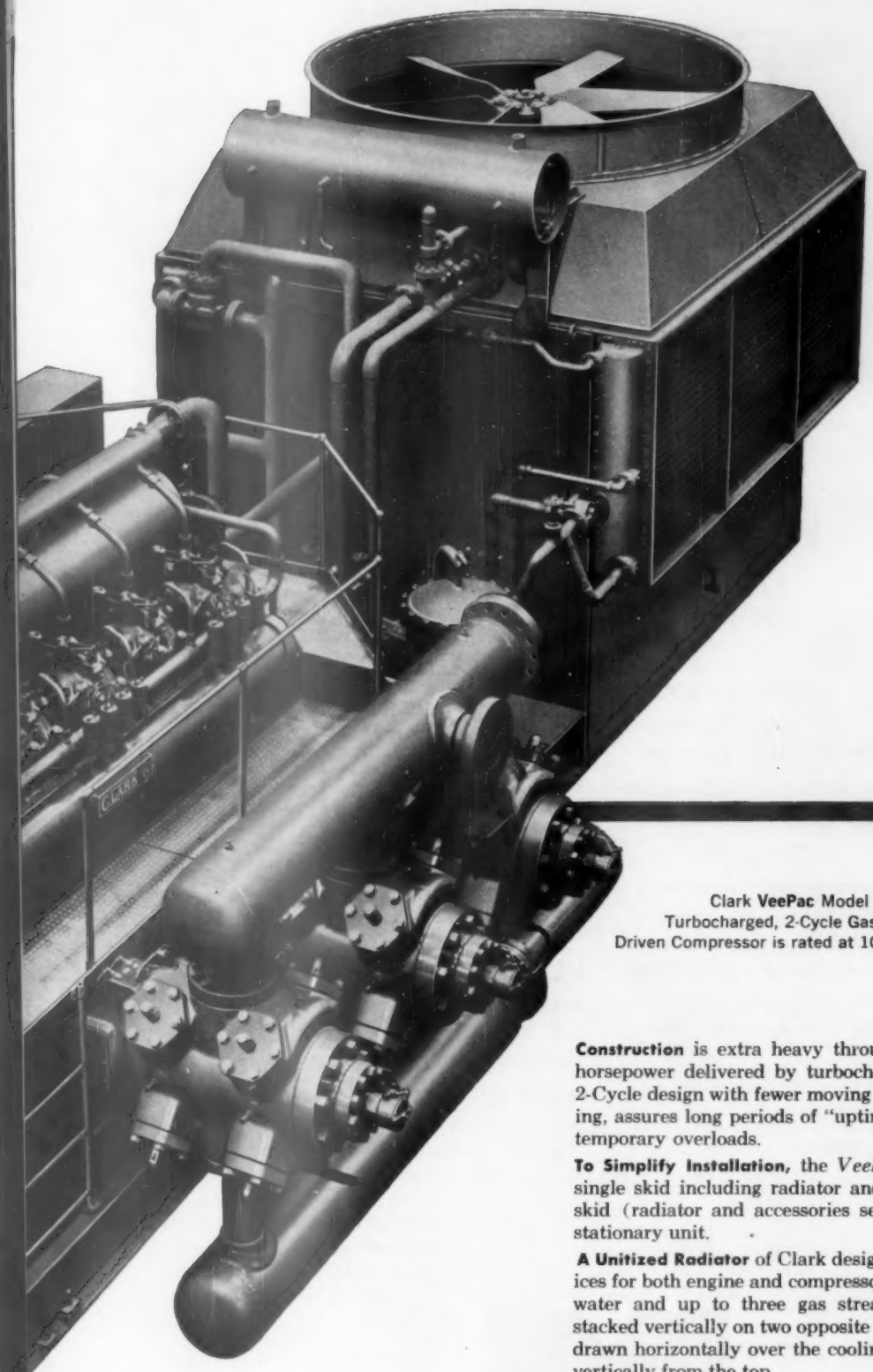

Clark **VeePac** Model TVM-12, Turbocharged, 2-Cycle Gas-Engine-Driven Compressor is rated at 1000 bhp.

Construction is extra heavy throughout to handle the high horsepower delivered by turbocharging. In addition, Clark 2-Cycle design with fewer moving parts and conservative rating, assures long periods of "uptime" plus ample reserve for temporary overloads.

To Simplify Installation, the *VeePac* can be mounted on a single skid including radiator and all accessories, a duplex skid (radiator and accessories separate), or supplied as a stationary unit.

A Unitized Radiator of Clark design provides all cooling services for both engine and compressor including lube oil, jacket water and up to three gas streams. Cooling sections are stacked vertically on two opposite sides of the radiator. Air is drawn horizontally over the cooling surfaces and discharged vertically from the top.

Available in Two Sizes—10 and 12 power cylinders rated at 825 and 1000 bhp respectively, the Clark *VeePac* Model TVM is designed to help you boost the efficiency of every compressor dollar you spend. For full information, contact your nearest Clark office or write for new illustrated Bulletin 191.

CLARK BROS. CO.

OLEAN, N. Y.

Engines Compressors Gas Turbines

Petrofos®

(fast-dissolving sodium tripolyphosphate)

New low-cost accelerator for secondary oil recovery!

Extensive laboratory tests and successful field applications have proved that PETROFOS greatly improves injection rate of waterfloods—*at low cost.*

At the water plant, a PETROFOS fresh-water solution is prepared—and then simply metered into the injection stream.

RESULTS? PETROFOS promotes wetting of reservoir surfaces by the treated floodwater—speeding up displacement of oil. With the same (*or even reduced!*) wellhead pressure, use of PETROFOS sharply increases both your water injectivity and oil-recovery rates. Flooding time shortens—assuring big operational savings.

PETROFOS field applications with a variety of well formations and injection waters have produced substantial injectivity increases.

TYPICAL APPLICATION (Bartlesville sand formation)		Average Water Injectivity (barrels per day/psi)
Before Treatment	August 1959	0.50
After Adding PETROFOS	December 1959	0.78
	May 1960	0.82
	September 1960	0.91

COST? Negligible—compared to savings that result. PETROFOS treatment in applications to date ranges from *only 5¢ to 20¢ per 100 barrels of water!*

WANT MORE FACTS? We'll be pleased to send you application and cost details outlined in our *Technical Bulletin 219.*

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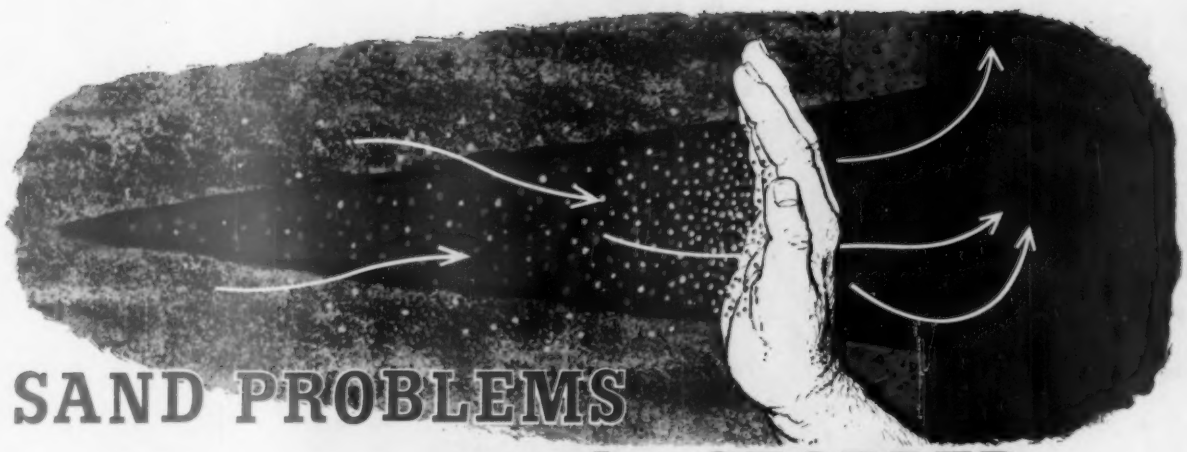
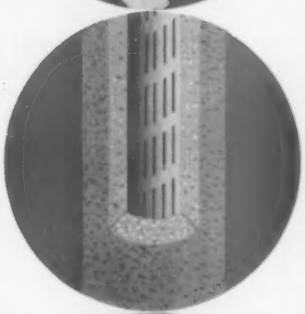
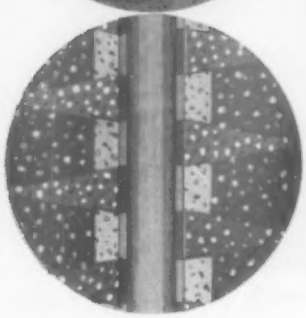


SAND PROBLEMS may be STOPPED

. . . with Halliburton Sand Control Methods!





SAND . . . spells *trouble!*

Halliburton's methods of Sand Control might spell an end to this trouble. How? By combating unconsolidated formation sand *at its source* — while it is still in the formation.

NEW HALLIBURTON SANCON

. . . is a multiple-stage chemical consolidating treatment especially for new wells. SANCON binds loose sand grains into a strong — yet permeable — structure. Downtime for a SANCON treatment is held to a minimum since the sand consolidation gains most of its strength within 10 minutes after placement. SANCON is not temperature sensitive.

NEW HALLIBURTON SANSET

. . . is another consolidation process. SANSET employs a pre-mixed plastic solution placed in one or two stages and allowed to react in the formation. Downtime is dependent on well temperature.

HALLIBURTON SAND SCREEN

. . . is a pre-formed liner that is very effective in almost any sand producing formation — new and old wells alike. Sand Screen consists of a slotted mandrel and a bonded outer layer of chemically inert, consolidated sand. This sand layer acts as a natural deterrent against the movement of formation sand into the producing equipment.

HALLIBURTON FRACPAC

. . . employs fracturing equipment and methods to place specially selected pack sand into the formation. The bridging action set up by Fracpac sand helps control the unconsolidated formation sand.

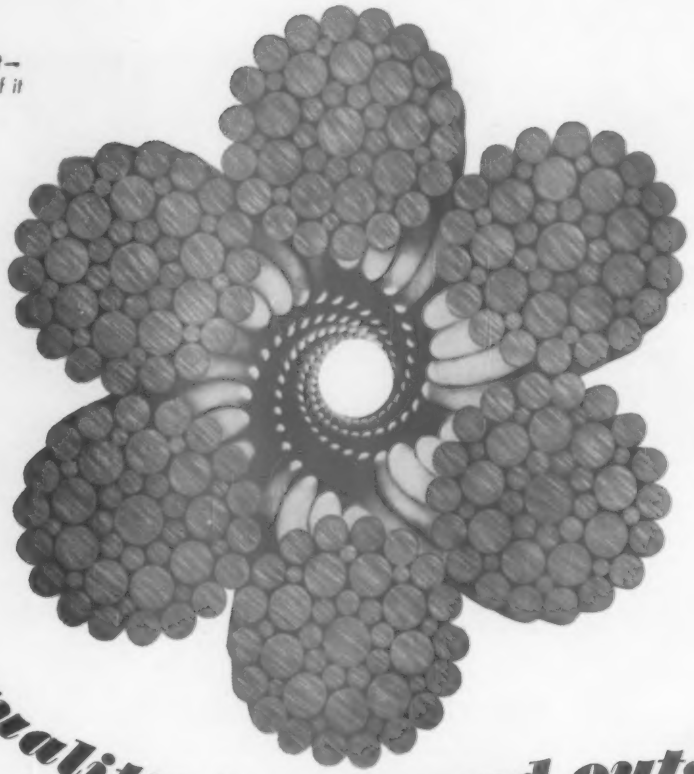
If loose formation sand is whittling away your profits let your Halliburton man explain his Methods of Sand Control.

FRACTURING SERVICES

275 Service Centers . . .
just minutes away from your well

Halliburton
COMPANY • DUNCAN OKLAHOMA

We put a lot of work into it—
You get a lot of work out of it



Quality inside and outside

Two important angles on wire rope savings: the *quality* and *uniformity* Roebling builds all the way through Royal Blue Wire Rope. They give you a big, extra margin of service through every kind of wear and tear — and combine to make extra strong Roebling Royal Blue the toughest wire rope you can buy. Find out more from your wire rope distributor, or write for free booklet to Roebling's Wire Rope Division, Trenton 2, N. J.

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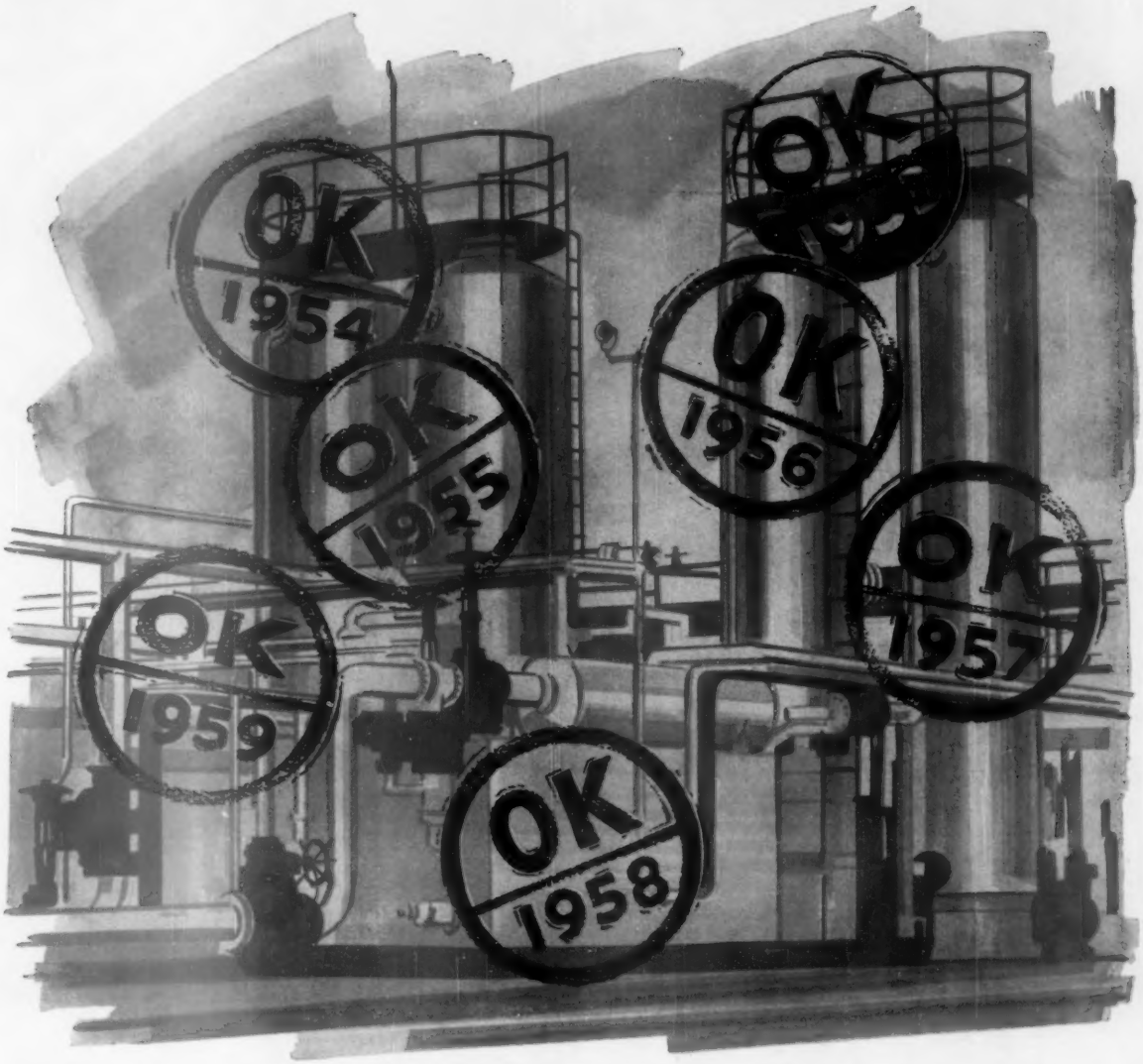


7 years of constant use . . .

and Davison Silica Gel still meets required dew point

In tower after tower, operation after operation, millions of cubic feet of natural gas are being dried in beds of Davison Silica Gel that were installed two, three and even seven years ago. In one large South Central gas treatment installation, Davison Silica Gel was still effectively removing moisture and maintaining satisfactory dew point after 29,690 consecutive hours on stream.

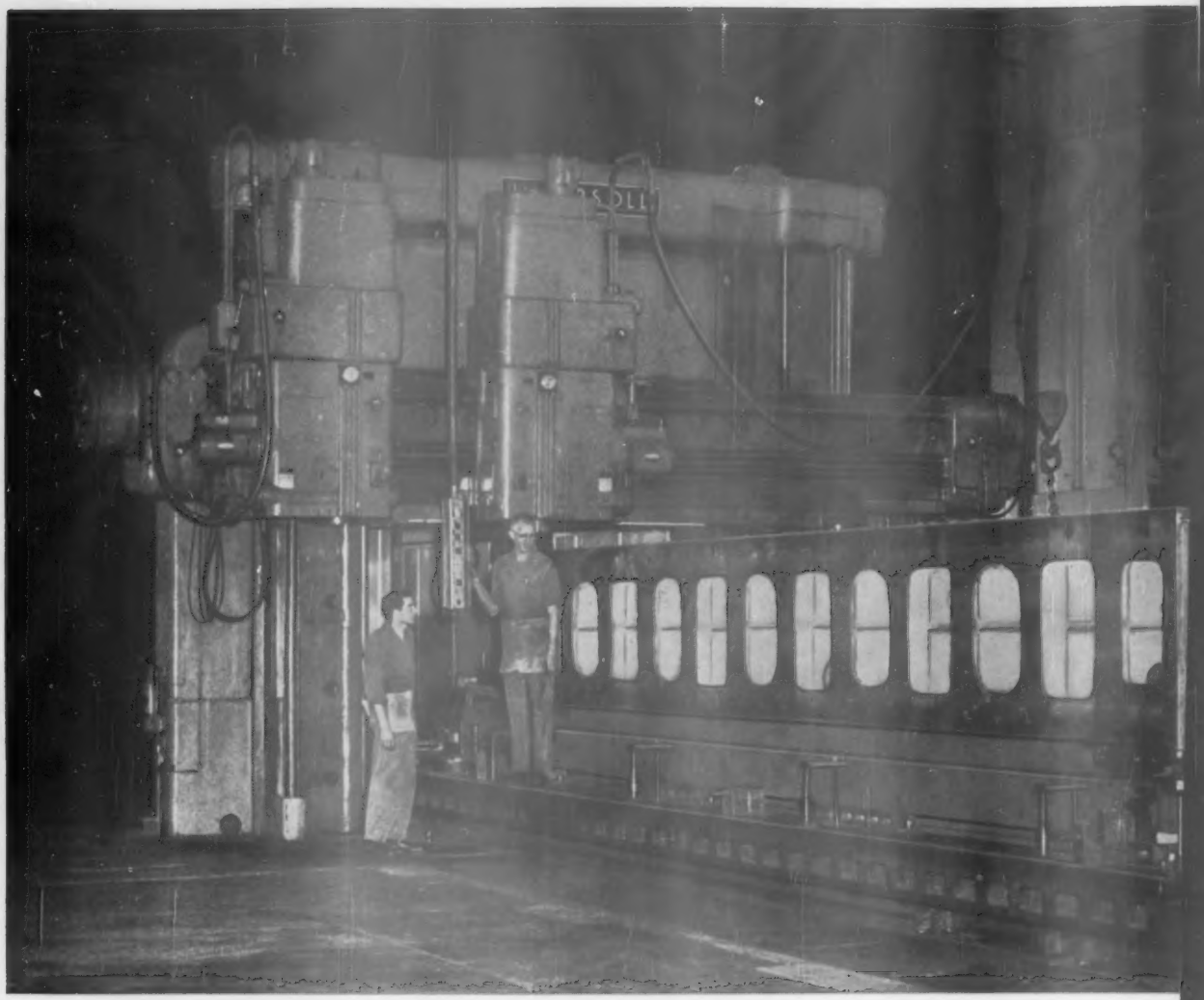
Davison Silica Gel's proven long-lived efficiency is one of the reasons it is being selected to replace other desiccants in increasing numbers of gas drying and hydrocarborn recovery installations. The higher purity of Davison Silica Gel reduces the possibility of carbon build-up in the desiccant pores. Higher purity, coupled with its larger surface area and granular form, has proven Davison Silica Gel to be an ideal desiccant.

For complete information on the advantages and profit-building potential of Davison Silica Gel for natural gas drying, write Dept. 3107.

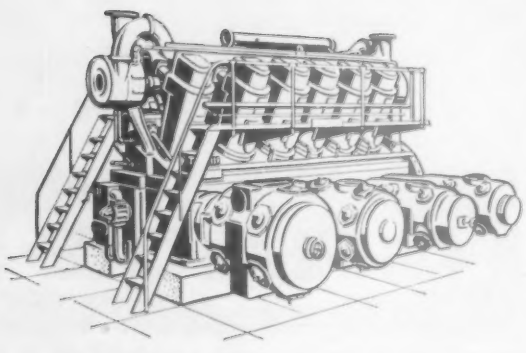
GRACE

DAVISON CHEMICAL

Industrial Chemicals Dept. 3107, Baltimore 3, Md.



"LIGHT-FINGERED GIANTS"

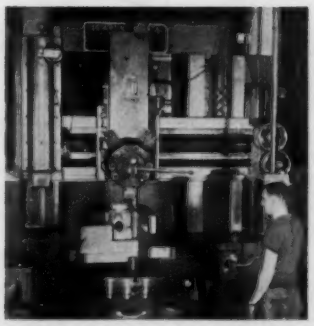


Dependability *begins* on the drawing board, but it becomes reality on the manufacturing floor. Here at Ingersoll-Rand's modern compressor plant in Painted Post, N. Y.—the largest in the world—gas-engine compressors and power units are built with the skill and precision of a fine watch.

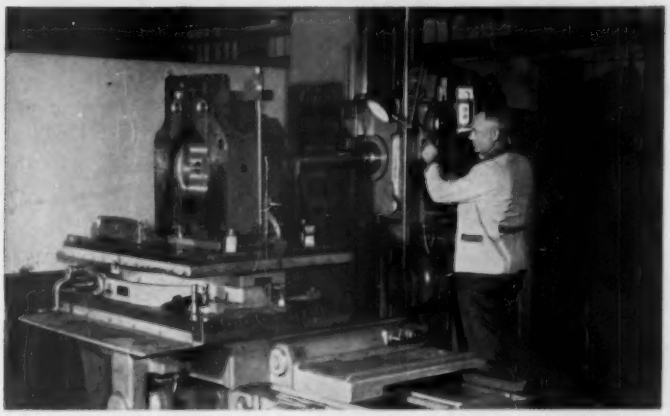
Even in large engine-compressors weighing almost half a million pounds, a ten-thousandth-inch tolerance can pay off in extra dependability and extra efficiency, with extra years of continuous full-load service on your job.

To achieve the close tolerances specified for all components, the Painted Post plant has been newly-equipped with the finest tools available, like the huge planer-type milling machine shown above. This unit, one of the world's largest, does all basic machining of large engine and compressor frames in a single setup to assure perfect alignment of running gear.

Crankshaft bearing saddles are electronically checked for vertical and horizontal trueness.



One of the large turret lathes used for roughing and precision-finishing operations on engine cylinders.



This boring-milling machine with positive-stop automatic positioning can machine power cylinder heads to tolerances of a ten-thousandth inch, permitting interchangeability without additional fitting.

that build extra dependability into engine-compressors

Machines alone can't do the job, and Painted Post is manned by skilled operators with years of experience in the most precise techniques.

This built-in *extra quality* is largely responsible for the outstanding service records established by I-R engine-compressors (120 to 4500 hp) on every type of job in all parts of the world. Ingersoll-Rand also offers the *most complete* line of compressors, in reciprocating, centrifugal, axial-flow, rotary and thermal types—there are units from ½ to 25,000 hp, for pressures from one micron to 125,000 psi.

These few pictures can't begin to show the modern facilities at Painted Post, but a trip through the plant would be an eye-opening experience for any prospective purchaser of compression equipment. Your Ingersoll-Rand representative will be happy to arrange a tour for you—call him today.

Ingersoll-Rand

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The World's Most Comprehensive Compressor Experience

Read between the lines. Continental-Emsco prices include experienced field men . . oil-field tough equipment . . top-notch service and many other *extras!*

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Retarded Acid Gets Results in Problem Wells

This table shows some of the recent results of Retarded Acid treatments performed by Dowell on problem wells in many areas. We hope it gives you some ideas that will result in greater profits from your wells.

LOCATION	NAME OF FORMATION	AMOUNT OF RETARDED ACID	RESULTS
Albert, Canada	Slave Point Mid Devonian Vugular lime	4000 gallons (acid-oil-emulsion type)	Production from old well went from 0 to 218 bopd.
Franklin County, East Texas	Limestone	30,000 gallons	16-fold gas production increase—from 400 mcfd to 6400 mcfd.
San Juan County, Utah	Paradox (Desert Creek Zone)	75,000 gallons (acid-oil-emulsion type)	Production boost from old well was 34 to 450 bopd in field where regular acid treatments are usually unsuccessful.
Ellis County, Kansas	Kansas City Lansing	2000 gallons (acid-oil-emulsion type)	Production nearly three times that of offset wells. $881 treatment cost paid out in 19 days.
Andrews County, West Texas	Pennsylvanian	10,000 gallons (acid-oil-emulsion type)	Production from old well boosted from 10 bopd to 60 bopd stabilized. This 50 bopd increase was made in a field where offset wells treated with 10,000 gallons regular acid usually yield an uneconomical 5 bopd increase.
Logan County, West Virginia	Big lime	4000 gallons	Production increased 100-fold to one million cfpd. Treatment cost paid out in two weeks. Entire well cost paid out in less than five months.
Lea County, New Mexico	Wolfcamp lime	3000 gallons (regular type) 15,000 gallons (acid-oil-emulsion type)	Well tested 275 bopd flowing. Other wells in field, given regular acid treatments, do not usually respond properly.
San Juan County, Utah	Paradox	40,000 gallons	Decline rate was reduced by treatment. Production was increased from 200 bopd to 700 bopd. Six months later production was still 700 bopd.
Alberta, Canada	D2	5000 gallons	Production from eight-year-old well had declined to zero with fluid level only 65 feet. One month after treatment, production had leveled off at 100 bopd, flowing.
Russell County, Kansas	Kansas City limestone	3000 gallons	Production boosted from 3 bopd to nearly 2000 bopd on test after clean-up.
McKenzie County, North Dakota	Madison lime	7000 gallons (acid-oil-emulsion type)	Production from old well increased from 35 bopd to 133 bopd after treatment. $3101.00 treatment paid out in 23 days.
Harrison County, East Texas	Pettit Oolitic lime	7000 gallons	Treatment of six-foot pay resulted in 40 mmcfd well with 60 barrels petroleum liquids per million.
Wabash County, Illinois	O'Hara lime (Highly soluble)	3000 gallons (acid-oil-emulsion type)	Well production stabilized at 75 bopd and treatment cost paid out in ten days. Regular acid had given poor results on nearby wells.
Fremont County, Wyoming	Embar lime	5000 gallons (acid-oil-emulsion type)	21 boph test from a pay that had been acidized and abandoned several years before. This treatment saved a well that would have been plugged otherwise.

Almost without exception, these treatments employed other Dowell products and services in addition to Retarded Acid. Most of the more recent treatments listed here were designed by Dowell engineers with the aid of the Acid Guide* – a method developed by Dowell for use in engineering acid treatments to get optimum results.

Take full advantage of Dowell's long experience, proved additives, and engineering ability. Call Dowell to perform your next acidizing treatment. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

SERVICES FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

TDOWELL SERVICE MARK

Move the man off the monkey-board

GUIBERSON

*Type **H** Hydraulic*

WIRE LINE OIL SAVER

Hydraulically operated, Guiberson's Type H Wire Line Oil Saver is controlled remotely by applying or releasing hydraulic pressure through a 50′ hose from pump to saver. The Type H effectively and uniformly cleans the wire line. This keeps the working area and equipment free of well fluids, reducing the hazards of fire and accident. Comply with Guiberson's slogan, "Better Be Safe Than Sorry," by using the Type H. There is no need for a man on the monkey-board during swabbing and redressing operations, which should please your insurance company.

Advantages of Type H Saver:

Hydraulically operated by field-proved piston principle . . no trouble-causing rubber bladders or complicated mechanism.

Large rubber and generous bushings give a smooth, constant seal. Rubber can be used until almost completely consumed.

Ram has 2½" hydraulic stroke with spring-actuated return.

Non-sparking, durable split bushings . . top and bottom interchangeable.

Saver is quickly and economically redressed at top of unit . . no threaded connections.

Bushings and rubbers for ⅜" to ⅝" or ¾" to 1" line.

Remotely controlled . . allows at least 50′ leeway from saver to pump.

For swabbing, gun perforating and other wire line operations, put the Type H to work. Ask your Guiberson man for a demonstration.

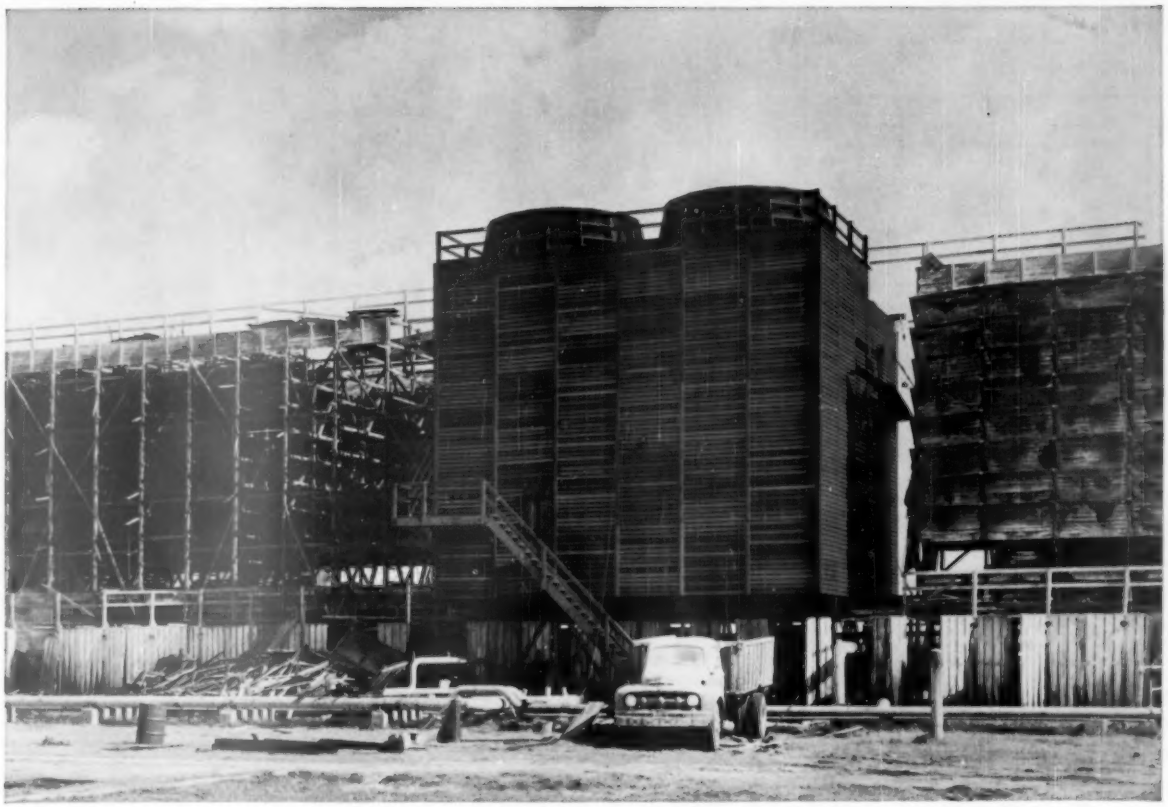
Long-life packing rubber and bushings.
Corrosion-resistant brass body.
Pressure gauge with marked operating ranges also indicates degree of rubber wear.
Hand controlled pressure relief valve.
Redressing tool.
Hydraulic pump with base.
Convertible to any field connection by changing only the base.
Fluid-filled 50-foot hose with check valve each end.

Sold by Oil Field Supply Stores Everywhere

THE GUIBERSON CORPORATION
DALLAS, TEXAS, U. S. A.

GUIBERSON — PRODUCTION, DRILLING AND WORKOVER SPECIALTIES, MOLDED RUBBER PRODUCTS

DRESSER INDUSTRIES INC. — OIL • GAS • ELECTRONICS CHEMICAL • INDUSTRIAL



HUDSON EXPERIENCE IN COOLING TOWER REPAIR, REMODELING AND REPLACEMENT — ASSURES SPEED, SKILL, AND INTEGRITY

For instance the above pictured HUDSON induced draft tower, 36 feet long, was erected in the area and on the foundations formerly occupied by the mid sections of a 162 feet long deteriorated natural draft tower. Exposed-tube coolers in the base of the original tower were left in place, and cooled water from the new tower distributed over these coolers. The completed installation is shown below.

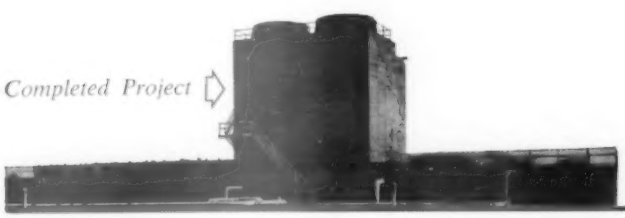
The work of dismantling, remodeling, and erection required 27 working days, and total shutdown time was less than 24 hours.

Although deterioration of the old tower necessitated its replacement, plant records show that increased revenue due to lower operating costs and greater product yield because of colder water, will give a *quick return of the investment.*

HUDSON maintains a cooling tower repair and replacement department staffed with experienced engineering and field personnel. Materials are stocked at HUDSON fabricating centers in California and Texas. If your cooling tower is *obsolete* or deteriorated avail yourself of HUDSON cooperation in developing the most economic replacement program.

In addition to water cooling towers HUDSON designs and manufactures SOLO-AIRE units (for cooling solely with air), and COMBIN-AIRE units (for cooling with combination of air and water). Only HUDSON is equipped to integrate these all-encompassing categories of equipment into cooling systems balanced to meet most economically specific conditions of climate, quantity and quality of water, and processing requirements.

Completed Project



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BRAEBURN STATION • HOUSTON, TEXAS

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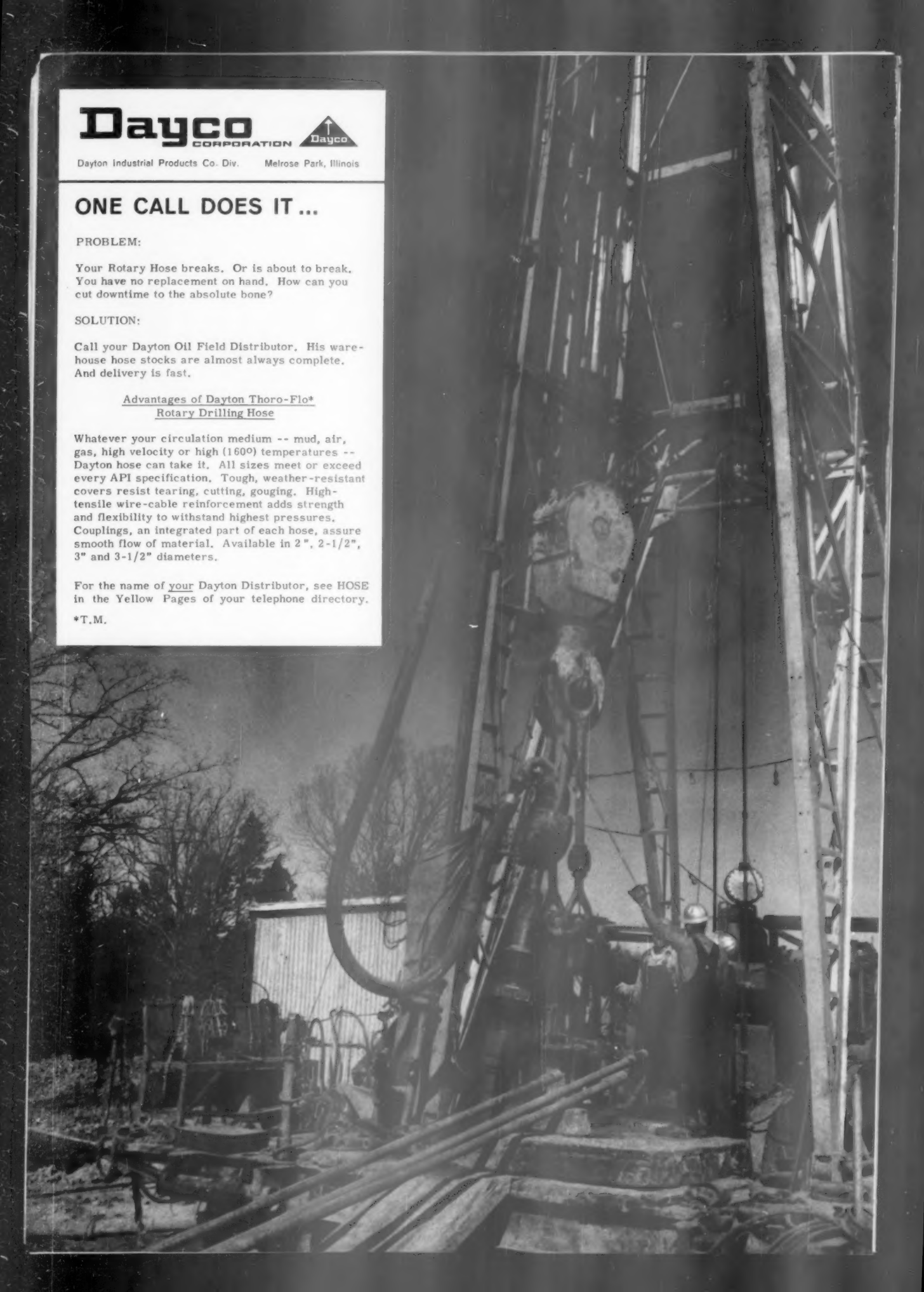


Dayco CORPORATION

Dayton Industrial Products Co. Div. Melrose Park, Illinois

ONE CALL DOES IT ...

PROBLEM:

Your Rotary Hose breaks. Or is about to break. You have no replacement on hand. How can you cut downtime to the absolute bone?

SOLUTION:

Call your Dayton Oil Field Distributor. His warehouse hose stocks are almost always complete. And delivery is fast.

Advantages of Dayton Thoro-Flo* Rotary Drilling Hose

Whatever your circulation medium -- mud, air, gas, high velocity or high (1600) temperatures -- Dayton hose can take it. All sizes meet or exceed every API specification. Tough, weather-resistant covers resist tearing, cutting, gouging. High-tensile wire-cable reinforcement adds strength and flexibility to withstand highest pressures. Couplings, an integrated part of each hose, assure smooth flow of material. Available in 2", 2-1/2", 3" and 3-1/2" diameters.

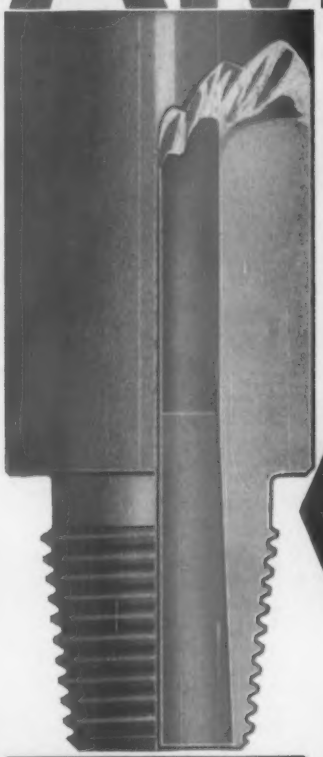
For the name of your Dayton Distributor, see HOSE in the Yellow Pages of your telephone directory.

*T.M.

More hole at LESS expense when YOU use

AMERICAN IRON

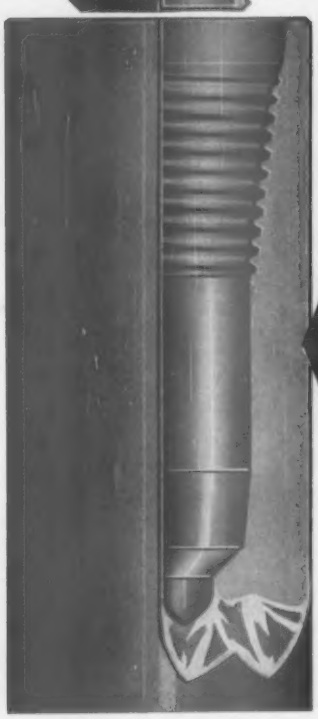
DRILL COLLARS



with **API** RECOMMENDED STRESS RELIEF CONTOURS

Laboratory fatigue tests and test under actual conditions have demonstrated the beneficial effects of stress-relief contours at the pin shoulder and at the base of the box thread. Other API recommendations for drill collars, to which AMERICAN IRON conforms, relate to diameter, bore size for given diameters and a selection of an API thread form.

Write AMERICAN IRON for these API recommendations or they may be seen on pages 14 and 15 of the API Standard 7, 16th Edition, April, 1960.



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- **PREMIUM STEEL . . . fully heat treated**
- **UNIFORM HARDNESS . . . from box to pin**
- **MICROIZED THREAD CONNECTIONS . . . prevents sticking and galling**

Available in Regular and Rol-Flex Connections!

PETROLEUM EQUIPMENT

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AMERICAN IRON & MACHINE WORKS CO., INC. • OKLAHOMA CITY •

DODGE

DART PICKUP

NEW FROM DODGE FOR '61

THE FIRST AND ONLY TRUCK WITH COMPACT-ECONOMY

Compact diet. Compact upkeep costs. Compact in everything but work capacity. A full half-ton hauler that'll do the dirty jobs every day, day in and year out. New right down to the wheel studs. New cab. New body. New and easier clutching, shifting, handling. Even a new soft sound. New standard 140 hp. inclined engine that can deliver gas mileage competitive with anything in its field, and do it on regular gas. That's how our tests worked out. And we wouldn't talk about it if you couldn't get the same results. The engine is slanted 30 degrees from the vertical for top-notch manifolding, both intake and exhaust. **THE '61 DODGE LINE?** All Dodge, all tough from end to end. Conventional and cab forward models, four-wheel drive series, Town Wagons for toting men and tools. Six and V8 gasoline power. Cummins diesels. A weight spread of 4300 lbs. GVW to 76,800 lbs. GCW. **PRICE?** The new Dart Pickup and the whole 1961 Dodge line of trucks are priced to compete with every truck coming or going. What more do you want? See your Dodge dealer now!

DODGE 4-WHEEL-DRIVE PICKUP Compact-economy plus the off-the-road agility of a mountain goat. Built to go anywhere you want to go without a whimper. Low-priced, too.

A PRODUCT OF CHRYSLER CORPORATION

The "OILWELL" string...

PRODUCTS
SERVICES
STORES

Here's why "Oilwell" Century Pumping Units pay dividends

There's always a reason for success. In the case of our Century Pumping Units, the reason is as plain as day: we designed them *after* we surveyed operators to find out what they wanted in pumping units. They asked for dependability, economy, simplicity and safety. We gave it to them in these outstanding Century features:

Their *dependability* comes from the primary structural elements being rigidly welded and perfectly aligned with front samson post legs widely spaced on a solid, T-shaped base. Their *economy* comes from wearing parts engineered for *heavy-duty* service. Their *simplicity* and *convenience* in well servicing comes from an easy-to-roll-back arc with automatic latch, and from a one-piece slant-slot yoke. Ease of care and operation comes from the fact that routine maintenance can be done at ground level. *Safety* comes from the Type G Cranks that make maximum use of counterweights and are easy to adjust with the operator working safely to the side of the unit . . . with lots of toe room between weights and floor.

From design theory to the smallest actual details, Century Pumping Units are the most modern, most efficient available. For full information, write or ask for a free copy of our descriptive booklet 27-61.

USS and "Oilwell" are registered trademarks

The service is great in The Pump Room

It's a different sort of menu than you'll find in Chicago's famous Pump Room, but you can't beat "Oilwell" pump shop service anywhere. Every "Oilwell" pump shop is staffed with specialists who have a background of technical and operating experience. They're there to help you with your pump problems, whether it's pump selection, maintenance, or reworking. On certain pumps, such as SPUN METAL sectional liner subsurface barrels, "Oilwell" offers an *exchange service* that gives you an indentical reworked barrel at less than half its original cost. No matter what your pump problem is, take it to the nearest "Oilwell" pump shop where you'll get the superior service that comes with every "Oilwell" product you buy.

Meet Don O'Bryan

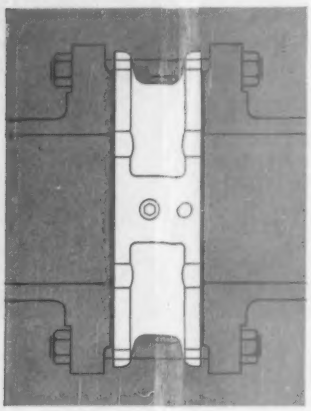
Don is the "Oilwell" store manager in Houston, and he has the background it takes to help you with your problems. He's been with "Oilwell" 28 years, and he knows the oil business inside and out.

Every "Oilwell" store manager is there to see that you get what you need—emergency-fast when necessary. From pumping unit and prime mover to the perforated nipple on the bottom of your tubing string, "Oilwell" stores are stocked with top quality producing equipment in the types and sizes that are locally popular. They carry everything you need from the hundred-and-one fittings, small tools and miscellaneous hardware to flashlight batteries and wiping rags. And store men like Don O'Bryan have access to the knowledge and up-to-the minute information to help you on practically any equipment problem. That's a good reason for stopping by your "Oilwell" store.

USS **Oil Well Supply Division of United States Steel**

Executive and Export Offices: Dallas, Texas

The Duo-Chek® is easily lowered into position between the flange faces; because of its light weight, special handling equipment is unnecessary. Fits standard valve flanges. In sizes 2 inch through 12 inch, one valve fits series 125, series 150 and series 300 flanges, saving inventory at less cost than a conventional 150 series. The machined outside diameter centers the Duo-Chek between series 300 flanges; the slots center it for series 150 flanges.



PAT. PENDING

MISSION DUO-CHEK NO SLAM CHECK VALVE

If your check valve problem is water hammer, Duo-Chek is the answer. If it's weight, maintenance, mounting position, or cost, Duo-Chek is still the right answer. The Duo-Chek performs all regular check valve duties, yet weighs only ten per cent as much.

The spring loaded, light weight sealing plates operate in any position—even in vertical lines with downward flow. The stainless steel coil spring effects positive sealing action. The quick action of the spring closes the valve before reverse flow can occur; therefore, no slam, no water hammer.

Duo-Chek valves come in a complete range of end connections and sizes from 2 to 48 inches, for ASA pressure ratings of series 125 through 2500, and for temperatures to 1400°F. They are made in steel, stainless steel, aluminum, and bronze. Sealing materials are Buna-N, Teflon, Viton, or metal depending on your service.

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Member
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They Say—

Home offered hall of fame

Dear Sir:

Mr. William Page's letter about the petroleum hall of fame in the June 19 issue ("They Say," p. 44) is of great interest to us in western Pennsylvania.

Baseball's hall of fame is at Cooperstown, N. Y., birthplace of the sport. Nothing could be more fitting than that the petroleum hall of fame be at Titusville, the birthplace of the industry.

Here at Drake Well Park we already have a museum in a 229-acre setting on the spot where the industry began. It represents an investment of perhaps $250,000. Within the next year Pennsylvania will spend $846,000 to enlarge Drake Museum into one of the finest industrial museums in the country.

It would seem only fitting if the industry would respond to this generous gesture on the part of Pennsylvania by establishing the hall of fame and furnishing Drake Museum with dioramas, scale models, and the exhibits that Mr. Page mentions.

We already have the priceless relics of the industry's early days—the photographs, the documents, the maps—something which no other industry in the world can boast of.

It is the hope of the Drake Park advisory board and of the Pennsylvania Historical and Museum Commission that the industry will finally realize what an asset it has here and will take sufficient interest in it by providing the exhibits that will make Drake Museum just as familiar to tourists—even more so, in fact—than Cooperstown. Certainly an industry has more of a story to tell than a sport.

James B. Stevenson
Publisher
The Titusville, Pa., Herald

It could be confusing

Dear Sir:

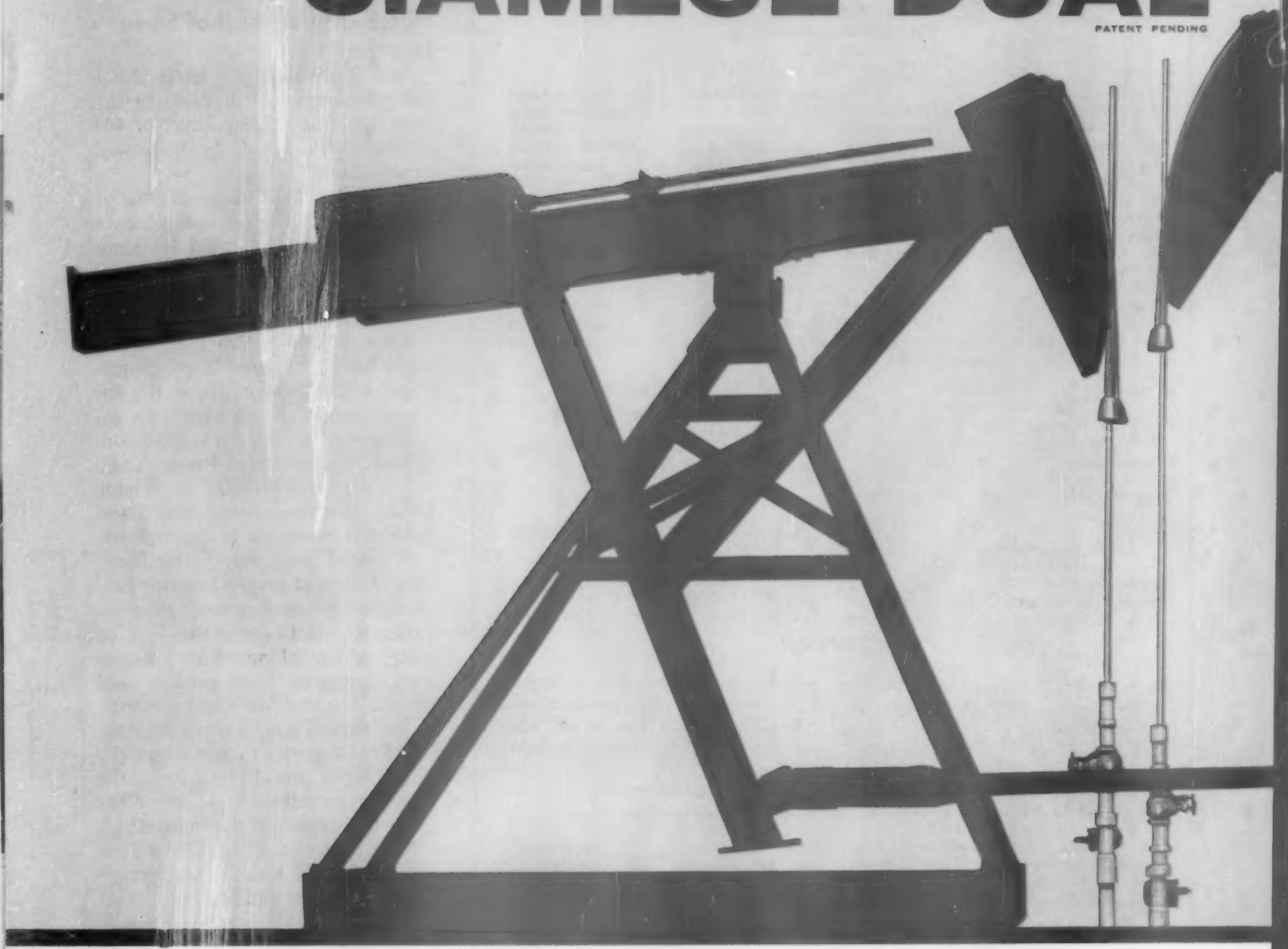
I would like to call your attention to several deletions and one transposition in the example calculations on page 94 of our article "Let Glycols Help Inhibit Hydrate Formation" (OGJ, June 19, p. 92).

While the deletions are not likely

American Manufacturing Company

"SIAMESE DUAL"

PATENT PENDING



MOST ECONOMICAL SURFACE EQUIPMENT FOR MULTIPLE COMPLETIONS EVER DEVELOPED

Unprecedented capital savings are made possible with American's new Siamese Dual pumping unit, which utilizes an API Primary Unit to operate a Secondary or "Slave" Unit through a special wrist-pin assembly. Investment is substantially less than for other methods because only one prime mover, one speed reducer, one V-belt set, one master control and related equipment, *of no larger size than for one zone alone,* are required.

Operational savings are gained through more efficient power utilization, less lubrication and *elimination of many expensive wearing parts,* which greatly reduces depreciation.

Outstanding efficiency of the Siamese Dual results from a 90° peak torque application. The peak torque for both units combined normally exceeds that for one unit alone by only 10% or less. Stroke length of each unit is adjustable, and the units can be of different size. Design is such that depletion of both zones is no problem.

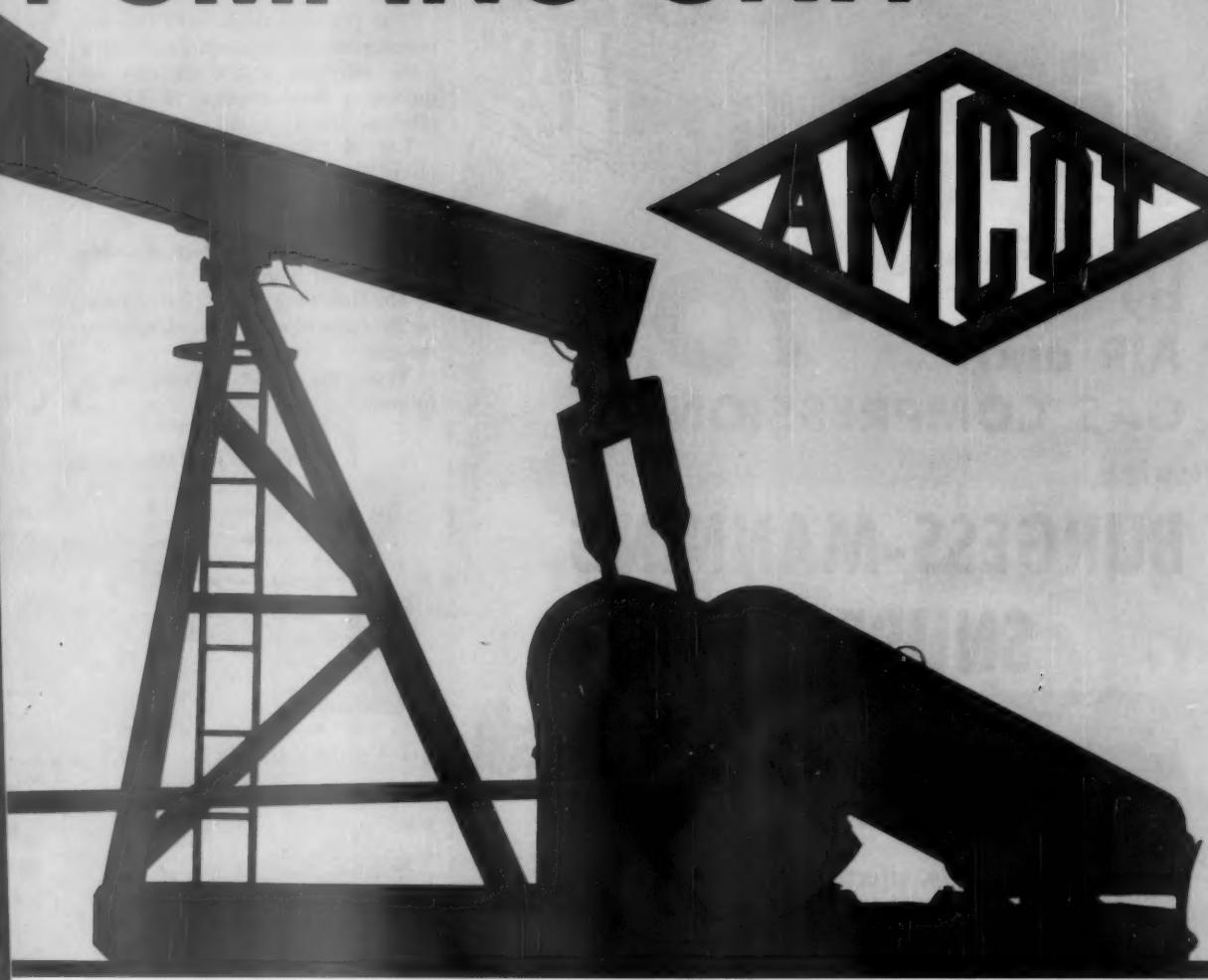
Siamese Dual Units are field proven in many U. S. and Canadian installations. In addition to dual zone pumping, they can also be used to increase waterflood volume tremendously. Contact us for complete information. We will bring to you a working model and films of Siamese Units in operation . . . without obligation.

THROUGH YOUR FAVORITE SUPPLY COMPANY

AMCOT **AMERICAN MANUFACTURING COMPANY**

of Texas presents the amazing new

PUMPING UNIT



SAMPLE SIAMESE SAVINGS

Well Conditions: Upper Zone: 4500 Feet, 1¼" pump, ¾"-⅝" Rods, 54" @ 16 SPM
Lower Zone: 5000 Feet, 1¼" pump, ¾"-⅝" Rods, 54" @ 16 SPM

TWO UNIT METHOD		ONE UNIT METHOD		SIAMESE-DUAL METHOD	
1 ea T11F54-11-D114Z w/7600# ECB	$3,608.00	1 ea T21F64-21-D228Z w/14410# ECB	$6,307.00	1 ea T11F54-11-D114Z w/7600# ECB	$3,608.00
1 ea T11F54-11-D114Z w/6970# ECB	3,543.00	1 ea "stacked" Mulehead	315.00	Primary "adder"	11.00
2 ea Frame Ext. for Elec. Mtr. only	130.00	1 ea Frame Extension	101.00	1 ea Frame Ext. for Elec. Mtr. only	65.00
2 ea Centerline Fdn Bolt Set	100.00	1 ea Centerline Fdn Set	104.00	1 ea Centerline Fdn bolt set	50.00
TOTAL UNITS	$7,381.00	TOTAL UNIT	$6,827.00	1 ea S11F54-11-D114Z w/6900# ECB	1,732.00
2 ea 20 HP Electric Mtr.	834.00	1 ea 40 HP Electric Mtr	791.00	1 ea Fdn bolt set	20.00
2 ea. 10" 4C Motor Sheave	64.46	1 ea 10" 6C Motor Sheave	44.28	TOTAL UNITS	$5,486.00
2 ea C-180 V-belt Set	88.32	1 ea C-180 V-belt set	66.24	1 ea 20 HP Elec. Mtr.	417.00
2 ea Control w/fuses	417.48	1 ea Control w/fuses	305.13	1 ea 10" 4C Mtr. Sheave	32.23
TOTAL ACCESSORIES	$1,404.26	TOTAL ACCESSORIES	$1,206.65	1 ea C-180 V-belt set	44.16
				1 ea Control w/fuses	208.74
				TOTAL ACCESSORIES	$ 702.13
GRAND TOTAL	**$8,785.26**	**GRAND TOTAL**	**$8,033.65**	**GRAND TOTAL**	**$6,188.13**

In addition to the capital investment savings shown, the Siamese Dual unit has lower power, maintenance and lubrication costs than the other two methods, and offers stroke flexibility not available in the one unit method.

OF TEXAS P. O. BOX 7037 • TEL. 1-817-TE 8-2301 **FORT WORTH, TEXAS**

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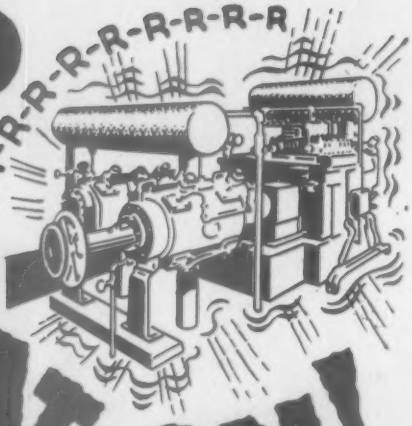
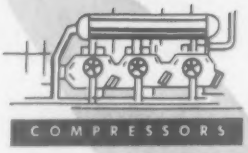
R-R-R-R-R-R-R-R-R-R



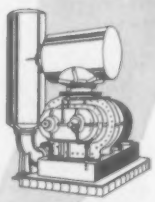
caused by AIR and GAS COMPRESSION with

BURGESS-MANNING SNUBBERS

The destructive effects of pipe system vibration and pulsation are completely eliminated with Burgess-Manning snubbers. Equipment performs better, maintenance costs are reduced and even structural damage to buildings is prevented. There are no moving parts . . . no maintenance . . . no repairs. Fabricated of heavy-gauge steel for long life. Let our engineers recommend a solution to your problems. No obligation, of course.



COMPRESSORS



BLOWERS

Industrial Silencer Division

BURGESS-MANNING COMPANY

The Sound-Engineering People

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REPRESENTATIVES WORLD WIDE

to compromise the end results, for someone unfamiliar with the mathematics involved it could be confusing. The correct form is given below with the missing parts circled.

The problem deals with the determination of injection rates for a 67% ethylene glycol solution requiring a final dilution of 41.8% ethylene glycol.

Let X = lb. of 67% ethylene glycol to be injected.

Let Y = lb. of 41.8% ethylene glycol to be recovered.

The water to be treated amounts to 13 lb. per hour.

The following calculation is made on the basis of only 1 lb. of water in the gas.

Thus, the water balance is as follows:

$$1 + 0.33X = 0.582Y$$

The glycol balance is:

$$0.67X = 0.418Y$$

$$X = \frac{0.418}{0.67}Y = 0.625Y$$

Substituting:

$$1 + (0.33 \times 0.625Y) = 0.582Y$$

$$1 + 0.206Y = 0.582Y$$

$$Y = \frac{1}{0.376} = 2.66 \text{ lbs. of } 41.8\%$$

ethylene glycol recovered per hour.

$X = 0.625Y = 0.625 \times 2.66$ = 1.66 lbs. of 67% ethylene glycol.

Other than the above deletions, the article was very well presented, and the editing, in my opinion, was most commendable.

John L. Arnold
Technical Service
and Development
Dow Chemical Co.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JULY

23-28 National Congress of Petroleum Retailers, annual session, Cosmopolitan Hotel, Denver.

26-28 American Petroleum Institute, Divi-

sion of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

27-29 Rocky Mountain Mineral Law Foundation, seventh annual institute, University of New Mexico, Albuquerque.

28 Southern Gas Association, transmission section, chief dispatchers' roundtable and compressor station operators' roundtable conference, Captain Shreve Hotel, Shreveport, La.

AUGUST

2-4 Wyoming Geological Association, sixteenth annual field conference, Green River, Wind River, and Powder River basins.

20-22 North Dakota Oil and Gas Association, ninth annual meeting, Plainsman Hotel, Williston, N. D.

20-24 Asphalt Institute, international conference on structural design of asphalt pavements, University of Michigan, Ann Arbor.

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

SEPTEMBER

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-8 Rocky Mountain Association of Geologists, field conference, Salida, Monarch, Ouray, Silverton, and Durango, Colo., areas.

7-9 Magic Plains Oil Exposition, Borger, Tex.

7-9 Alberta Society of Petroleum Geologists and Geological Association of Canada, convention and field trip, Canadian sedimentary basins, Calgary.

11-15 Instrument Society of America, fall instrument-automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14 Natural Gasoline Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

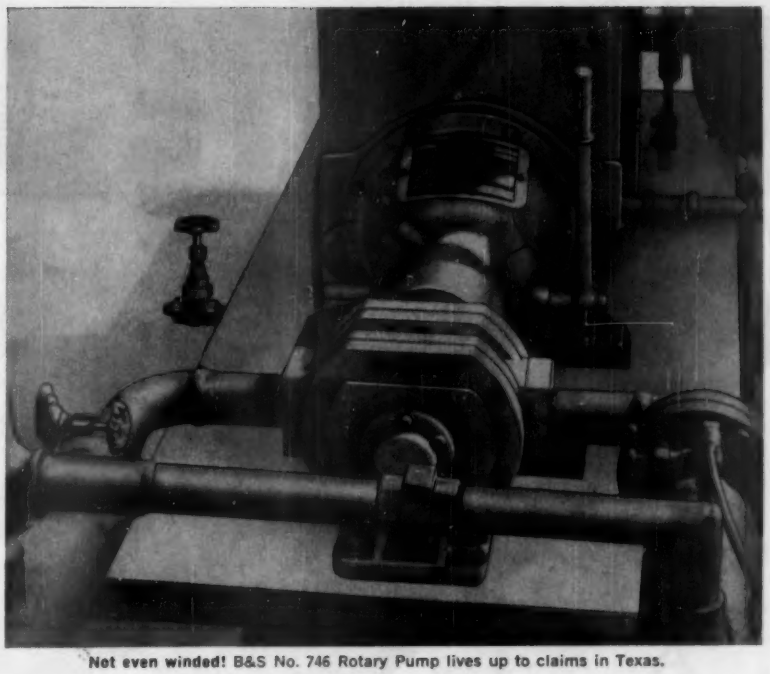
17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

18-20 Standards Engineers Society, tenth annual meeting, Hotel Sherman, Chicago.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

20-21 American Institute of Electrical En-



Not even winded! B&S No. 746 Rotary Pump lives up to claims in Texas.

120,000 barrel warm-up!

New Brown & Sharpe pump shows no noticeable wear in first 8 months use by big pipe line company

Are the new B&S petroleum industry pumps as dependable as we say?

You bet they are!

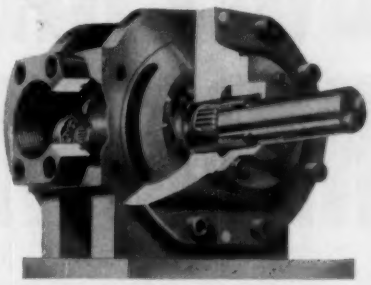
Take this Brown & Sharpe rotary pump, installed Sept. 7, 1960, by a famous pipe line company . . .

Careful maintenance checks show no noticeable wear of either rotor elements or bearings. The change in clearance between pump case and rotor is insignificant.

Without replacement of a single part, the Brown & Sharpe pump is still operating as efficiently as when new — after delivering 120,000 barrels of crude.

You can count on dependable B&S pumps to cut your maintenance costs — in rugged transfer, injection, gathering and hydraulic power duty.

Send for literature, to Hydraulics Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



B&S 700 Series Pumps utilize gerotor principle for smooth flow, high efficiency, long life. Capacities: 20, 30, 40, 60, 80 gpm. Pressures: To 1000 psi. Viscosities: 50 to 50,000 ssu.

Brown & Sharpe

PRECISION CENTER

Trinity LITE-WATE

A complete low density cement that is

SULPHATE RESISTANT

Shown above are three unretouched photos of test bars produced from TRINITY LITE-WATE neat slurry that were immersed in a 5% sodium sulfate–5% sodium chloride solution for a period of more than one year. These bars are completely sound and show no expansion.

In the range of lightweight cement slurries, TRINITY LITE-WATE produces a slurry which is:

1. Sulfate resistant for lasting casing protection.
2. Remains impervious to migrating fluids.
3. Light enough to circulate.
4. Strong enough for any casing seat.
5. Strong enough to permit hydraulic fracturing.
6. Easy to mix, easy to pump.

For TRINITY LITE-WATE cement call your service company.

For complete Laboratory Data call your local Trinity Representative or write Dallas Office, P. O. Box 2698 or phone RIverside 2-8111.

75 lb. Dry Volume per cubic foot

TRINITY

PORTLAND CEMENT DIVISION

GENERAL PORTLAND CEMENT COMPANY

DALLAS·FT.WORTH·HOUSTON

gineers, Institute of Radio Engineers, Instrument Society of America, industrial electronics symposium, Bradford Hotel, Boston.

24-27 American Institute of Chemical Engineers, national meeting, Lake Placid Club, Lake Placid, N. Y.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

25-28 American Welding Society, fall meeting, Adolphus Hotel, Dallas.

OCTOBER

1-4 American Gas Association, annual convention, Dallas.

3-4 University of Kansas, ninth annual gas measurement institute, National Guard Armory, Liberal, Kans.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

8-11 Society of Petroleum Engineers of AIME, annual fall meeting, Memorial Auditorium, Dallas.

11-12 Western Petroleum Refiners Association, waste disposal and stream pollution conference, Hotel Lassen, Wichita.

12-13 California Natural Gasoline Association, annual fall meeting, Lafayette Hotel, Long Beach, Calif.

15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.

15-18 American Petroleum Credit Association, annual conference, Shamrock-Hilton Hotel, Houston.

17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.

18-20 Rocky Mountain Oil and Gas Association, annual convention, Denver-Hilton Hotel, Denver.

18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.

19-22 Louisiana Gulf Coast Oil Expedition, Lafayette, La.

24-25 Pennsylvania Grade Crude Oil Association and Pennsylvania State University Mineral Industries Experiment Station, technical conference on oil recovery by solvents, Pennsylvania State University campus, University Park.

24-25 University of Kansas, Southwest Kansas Center, pipeline institute, Court House, Liberal, Kans.

24-27 National Association of Corrosion Engineers, south-central region conference and exhibition, Shamrock-Hilton Hotel, Houston.

25-26 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

25-27 Gulf Coast Association of Geological Societies, annual meeting, Granada Hotel, San Antonio, Tex.

27 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.

29-Nov. 1 National Lubricating Grease Institute, annual meeting, Rice Hotel, Houston.

FACTS FOR REFINERS

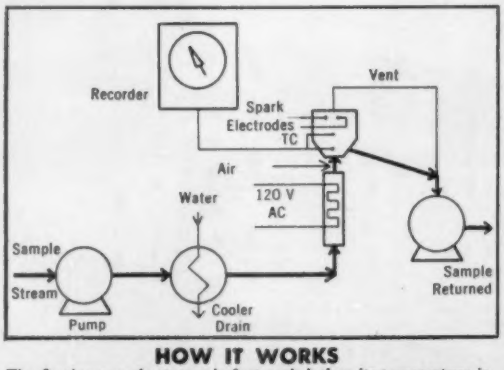
psd

INSTRUMENTATION FOR AUTOMATION

FLASH POINT CONTROL ADDS $45,625 TO ANNUAL PROFITS

American Oil Company told the API Division of Refining at its Mid-year Meeting, that *continuous* flash point testing adds $45,625 to the annual profit of a refiner producing 10,000 B/D of distillate fuels. No. 1 fuel oil can accommodate more heavy naphtha and total production can be increased about 5% by bringing the flash point 5°F. closer to specifications*.

Controlling flash point quality to the optimum level requires continuous monitoring, in contrast to normal practice of submitting only 1 or 2 stream samples once each shift to the laboratory. The CONTINUOUS FLASH POINT RECORDER, developed by Standard Oil Company (Indiana) and licensed exclusively to PRECISION SCIENTIFIC DEVELOPMENT, automatically determines flash every 5 minutes. Results correlate with ASTM Tag Closed test (D56) within 2°, and can be read immediately, enabling operators to pin-point the most effective process adjustments to virtually eliminate off-test production.



HOW IT WORKS

The flowing sample stream is first cooled, then its temperature is slowly raised; air is injected. Sample temperature is recorded electronically prior to exposure to high voltage sparks every other second. Following flash, recording pen automatically drops; cycle ends; 2-minute cooling begins, cycle recommences.

Continuous flash point control also gives more distillate production, to meet seasonally heavy demands, without increasing crude runs and processing costs. About 2000 B/D more crude would be required to provide 500 B/D more distillates. Increasing crude runs increases costs and aggravates the problem of maintaining balanced production. Flash point control also helps reduce other refinery costs, for example, if reprocessing of off-test material is reduced by 1% of total production, savings can amount to $20 per day . . . $7300 per year.

Typical Benefits of Flash-Point Control of No. 1 Fuel Oil

	B/D
Nominal Production	10,000
Added production by 5°F. lower flash point	500
	Dollars
Differential value of added stock, per bbl.	0.25
Value of 5°F. lower flash point, per day	$125.00

Other CONTINUOUS FLASH POINT RECORDER advantages are savings in time and protection against hidden errors and contamination. Process decisions can be made promptly and blending operations speeded by virtue of the continuous record and elimination of delays. Samples are taken directly from a process line, excluding sampling errors. The recorder eliminates oral reporting of test results, avoiding transcription errors. When used to monitor bulk deliveries of products to pipe line or tankers, it safeguards against leaky valves, poor mixing and contamination.

Refiners should study how the CONTINUOUS FLASH POINT RECORDER can add to profits. Request Bulletin No. 702. Let us help solve your special problems.

*PROCESS MONITORS SAVE MONEY AND IMPROVE EFFICIENCY
S. F. Kapff and R. B. Jacobs
American Oil Co., Whiting, Ind.

Precision Scientific Development
3745 West Cortland Street
Chicago 47, Illinois

The newest reason to make your next tandem a FORD:

'61 FORD HEAVY DUTIES

GIVE TWICE THE CAB, FENDER AND RADIATOR LIFE!

Rugged Ford Heavy Duties utilize heavier gauge steel, sturdier reinforcements, and a new independent mounting system to separate cab, fenders and radiator. This stronger construction, with each component *individually* frame-supported, doubles cab, fender and radiator life—cuts downtime delays and maintenance expense.

CAB—A 25% heavier floor pan and toeboard provide a solid base for greater cab durability. New full-length door pillar reinforcements and stronger inner door panels minimize door sag. New triangular mounts keep cab level and protect it from frame-movement stresses.

FENDERS—Ford fenders are 25% heavier gauge, too. They are bolted to a rubber-cushioned transverse support in front for needed flexibility. Fender-wide rear brackets provide necessary rigidity. The removal of only 9 bolts permits pulling the fender assembly for easier access to engine.

RADIATOR—New Ford "lock-seam" construction doubles the solder area on key seams, and heavier gauge tank and header walls provide increased radiator strength. "Horse collar" mounting on rubber pads soaks up vibrations and diagonal braces at sides give solid support.

Ford's separate mounting of cab, fenders and radiator frees them from frame-movement stresses that occur when these parts are rigidly attached to each other. Result: failures and service costs are reduced even in tough off-road operation.

Ford T-Series tandem rear axle trucks and tractors are available with GVW's up to 51,000 lb.—GCW's up to 75,000 lb. Your choice of Timken or Eaton axles with up to 38,000 lb. tandem capacity. Seven exclusive-truck V-8 engines range from 302 to 534 cubic inch displacement.

SEVEN MORE REASONS WHY IT'S GOOD BUSINESS TO DO BUSINESS WITH FORD!

You save from the start with Ford's traditionally low prices, and your savings continue with low operating and maintenance costs. These facts are documented by certified test reports from America's foremost independent automotive research firm. Ask to see these reports. They're on file at your Ford Dealer's.

In addition to these dollar-and-cents savings, the following bonus benefits are yours with Ford Trucks:

1. **Rigid quality controls** give you the strongest safeguard of truck reliability ever. Modern, *exclusive-truck* manufacturing facilities, with emphasis on quality every step of the way, are designed to give you a Ford Truck that is as free from defects as a truck can be. Tangible results of these high standards are Ford's new warranties.

2. **Exclusive 100,000-mile warranty** (or 24 months) on 401-, 477- and 534-cu. in. Super Duty V-8's is the most liberal in the industry. Each major engine part (including block, heads, crankshaft, valves, pistons, rings), when engine is used in normal service, is warranted by your dealer against defects in material or workmanship for 100,000 miles or 24 months, whichever comes first. The warranty covers full cost of replacement parts . . . full labor costs for first year or 50,000 miles, sliding percentage scale thereafter.

3. **12,000-mile warranty** (or 12 months) on all 1961 Ford Trucks of every size is further evidence of the confidence Ford has in its quality controls. Each part, except tires and tubes, is now warranted by your dealer against defects in material or workmanship for 12 months or 12,000 miles, whichever comes first. The warranty does not apply, of course, to normal maintenance service or to the replacement in normal maintenance of parts such as filters, spark plugs and ignition points.

4. **Special fleet financing** can be arranged by your Ford Dealer. It's available for owners of two or more trucks, and provides the opportunity to precisely tailor payments to your income patterns or depreciation schedules. This fleet-fitted financing offers substantial savings and frees your working capital.

5. **Sales engineers and service specialists** in 36 district offices are on call to solve special truck problems. Working with both dealers and customers, these experienced truck men represent another extra step Ford takes to provide your continued satisfaction.

6. **Replacement parts depots** at 26 strategic locations across the country quickly supply needed parts from ample stocks. Ford's entire supply system is geared to give you faster service and reduce costly downtime . . . *wherever* you are.

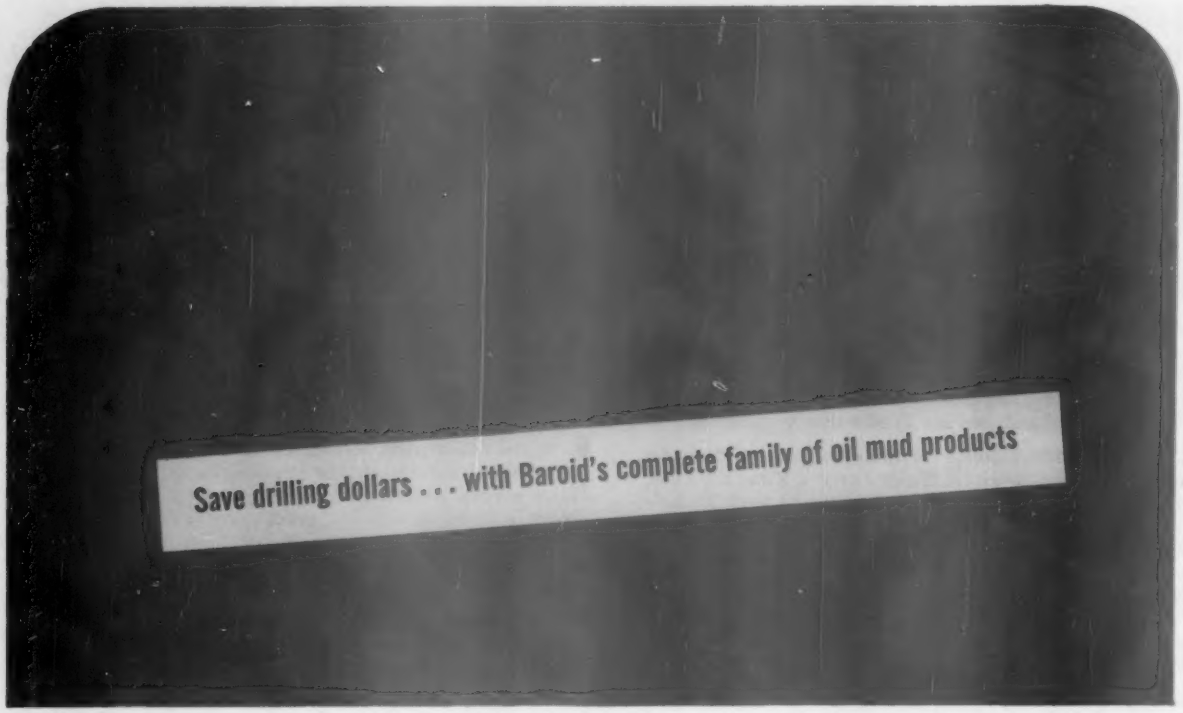
7. **6,800 Ford Dealers,** including 280 specialized Heavy Duty truck dealers, can keep your trucks ready to go wherever they go. From coast to coast, fast Ford service—gas *and* Diesel—is always close at hand.

From Super Economy pickups to Diesel-powered tractors, you can now fill every truck need up to 76,800 pounds GCW with a modern, money-saving Ford Truck.

Quality-Built...Maintenance-Engineered

FORD TRUCKS COST LESS

FORD DIVISION, Ford Motor Company



Baroid Field Report: Los Angeles County, California. This case history exemplifies the application of one type of a Baroid Oil Mud used to solve this particular problem.

Baroid Oil Mud solves water-sensitive pay sand problem

A Baroid Oil Mud containing INVERMUL*, PETROTONE** and DURATONE** was recently used successfully to prevent water damage to productive oil sands in the Inglewood Field, Los Angeles County, California.

The water-sensitive formations and high bottom-hole temperatures encountered had previously prevented completing below 7,500 feet without water damage. These difficulties were attributed to formation damage by the filtrate from conventional water muds.

The well was spudded and 16" casing set at 550 feet. An AQUAGEL*-caustic soda-CARBONOX* emulsion mud was used to drill to 3,000 feet—10¾" casing set. The AQUAGEL-CARBONOX mud was treated with TRIMULSO* and used to drill to 7,400 feet. At 7,400 feet the oil-in-water-emulsion mud was displaced with a pre-mixed Baroid Oil Mud containing INVERMUL and DURATONE. No difficulty was encountered during the displacement. Water mud incorporated into the oil mud did not alter its flow properties.

PETROTONE (2 lb/bbl) was used to treat this oil mud to eliminate the possibility of any settling of BAROID* at the high bottom-hole temperature.

DURATONE controlled filtration at 0.0 to 0.5 ml, all oil. This control insured against filtrate damage to formations.

Baroid Oil Muds, product of Baroid research and engineering, saves your drilling dollars and keeps your drilling program on schedule. For more information on the unique properties and flexibility of Baroid Oil Muds write for Product Data Sheets.

6117

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY
MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

*INVERMUL, emulsifier; AQUAGEL, bentonite; BAROID, weight material; CARBONOX, thinner; TRIMULSO, surfactant; are Registered Trademarks of Baroid Division National Lead Company.
**PETROTONE, suspending agent, and DURATONE, filtration stabilizer, are Trademarks of Baroid Division National Lead Company.

the Journal said...

50 years ago

July 20, 1911

A natural-gas price war between Dominion Natural Gas Co. and Peninsular Oil & Gas Co. has cut rates to consumers in Vienna and Port Burwell, Ont., Canada, to 15 and 10 cents per M.c.f., respectively. Both companies are offering free connections and service from their newly completed competing distribution systems with lines from a new nearby gas field in which both companies have production.

A new practice of flooding oil wells with hot oil to increase their production is being tried out in Midway field of California. Some operators also are experimenting with the idea of forcing oil from wells by compressed air. Another new development at Midway is the replacement of steam engines with gas engines for pumping and other power requirements.

25 years ago

July 16, 1936

Three-day celebration commemorates tenth anniversary of discovery of oil production in Seminole area of Oklahoma. Granite marker dedicated at site of discovery well, drilled by R. F. Garland and Independent Oil & Gas Co., and abandoned 2 years ago. Pageant revives memories of mad, boom days of this epochal oil field, scene of first rotary drilling on large scale outside Gulf Coast area.

Discovery well of Flour Bluff field, southeast of Corpus Christi at coastal tip of Nueces County, comes in as one of South Texas' most significant oil developments in several years. M. Hurburt's 1 Phillips discovery well flows 23 bbl. of 43°-gravity oil per hour through small chokes from 6,580-ft. Marginulina sand.

10 years ago

July 19, 1951

Six companies join in project to build 24-in. crude-oil line from West Texas to Houston-Texas City area. Participants in new $35,000,000, 463-mile Rancho Pipe Line System include Shell Pipe Line Co. (operator), Sinclair Pipe Line Co., Pan American Pipe Line Co., Phillips Pipe Line Co., Nantucket Pipe Line Co. (Eastern States Petroleum Corp.), and Tidewater Pipe Line Co. (Crown Central Petroleum Corp.).

Acute shortages of oil face many areas of the world following shutting down of Anglo-Iranian Oil Co.'s huge Abadan refinery and loss of Iranian oil in Iran nationalization dispute. United States Government ponders ways to help fill void in world supplies.

JOURNALLY SPEAKING

Don't Let It Bug You

HEY, the electricity people better take a hand in this national-fuels-policy study that Congress maybe is or isn't going to make.

Something has just come up that may put them out of business by making electric lights obsolete.

It's those darned scientists again. Scientists are always inventing some new thing or process that displaces the good old ways of doing things, knocks established products off the market, and throws people out of work. It's *most* upsetting.

The latest result of this meddling is the discovery of a way to make synthetic luciferin. Luciferin is a substance that produces a cold light by a chemical process, exactly the way lightning bugs do it.

The word "lucifer" means light, and it also means Satan. And this new kind of light could raise the very devil with the electric industry. Whereas the ordinary electric light bulb converts only 3% of its energy into light, the firefly's luciferin converts 95% of its energy into light.

The way to make synthetic luciferin was developed by Johns Hopkins University scientists, who got enough of the natural stuff to analyze by having Baltimore school children collect 8,000,000 fireflies. This kept the kids out of mischief in summer evenings and doubtless reduced Baltimore's juvenile-delinquency rate appreciably. It also permitted the scientists to explore the mysteries of bugology and the love life of Wa-Wa-Tay-See.

These are commendable objectives, but the trouble is that things like this never stop there.

Now look what's likely to happen: Some smart cookie, motivated solely by crass commercialism, is going to go into the business of manufacturing synthetic luciferin and the appliances to use it for lighting homes, stores, and factories. Since its efficiency is so much greater than electricity's, luciferin would soon displace electric lights.

And with the lighting market gone, the electric utilities would quit buying much coal, oil, or gas for generating purposes, and thus the nation's whole fuel economy would be ruined.

This might happen, that is, unless we have a national fuels policy, a good firm fuels policy that would prevent such disturbing developments from occurring by allocating uses for various fuels and making certain that these markets won't be lost through competitive forces or technological developments.

Things are bad enough as they are, without these fireflies getting into the act. The competition among fuels is something awful. Gas lights are displacing electric bulbs on countless lawns and patios. Charcoal broilers keep kitchen stoves cold many a summer evening. Gas companies are developing do-it-yourself package kits to generate electricity with a turbine in the hall closet. And goodness knows how many laboratories are working overtime to invent a fuel cell that will make *everything* obsolete.

And then there is the threat of atomic energy, solar heat, and magnetohydrodynamics (surely you're aware of how bad *that* could be). Add all these to the normal competition among fuels, and the way people are raiding each other's markets these days, and the uncertainty over what FPC may do in gas regulation, and the amount of Venezuelan fuel oil to be imported, plus a few other problems, and you can see how tough things are.

It's getting so a body can't predict the course of an industry for 10 or 15 years with any assurance at all, and that's bad for stability.

Looks like we just gotta have a national fuels policy that will keep everything even and orderly, control upsetting technological developments, and get the bugs—at least the lightning bugs—out of the fuels business.

—Henry D. Ralph

Sure it's a dual completion— But is it a dual producer?

Many dually-completed wells have "pay" zones that aren't producing—for want of a recompletion job. These are *pay* zones only in the sense that you have paid for the completion.

In such cases, recompleting with Sidewinder-Sidekicker is like throwing good money after *good*. It's the only safe way to redo the job without disturbing production below, the one way to activate "pay" zones that aren't paying.

The Welex Sidewinder is a remarkable gun. It runs through tubing as small as 2" with standard seating nipples. It packs the maximum charge in a minimum of space. It is mechanically oriented and decentralized by the Welex Sidekicker. A retrievable gun carrier absorbs the shock of the detonation and returns *every bit* of debris to the surface. Nothing neater, safer or surer.

Don't be satisfied with producing a single zone when you've paid for a dual completion. Reperforating is now very simple and economical, thanks to the Sidewinder-Sidekicker. Remember, no derrick, no danger, no debris.

Call Welex on your next completion or workover. Welex has more years of perforating experience and a wider variety of wireline services than any other company.

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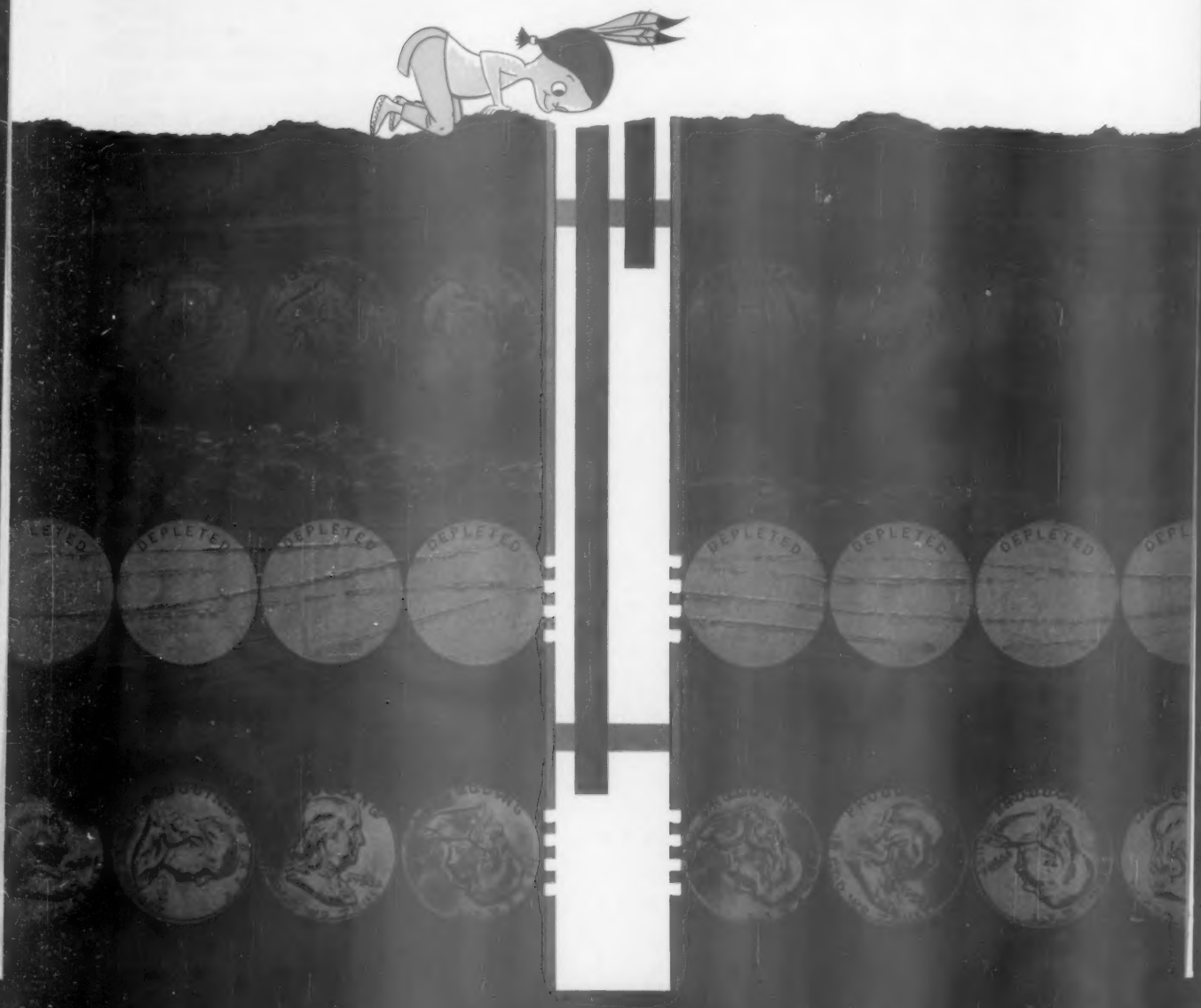

AGA propaganda distorts the facts of gas supply

OF ALL THE misleading statements fed to the public about the gas business and its regulation, the baldest propaganda is that disseminated by the American Gas Association.

The AGA speaks for retail distributors of gas, the city utilities. Its "party line" is that gas sales will continue to expand rapidly as in the past and that there need be no concern about future supplies.

Apparently its purpose is to lull investors, politicians, customers, and equipment manufacturers into complacency with things as they are and to prevent reshaping federal regulation on a realistic basis.

IN A "PRESS KIT" recently distributed to the nation's newspaper editors as a reference source, AGA said "proved recoverable reserves have more than kept pace with increased production."

That's a half-truth. The half that is true is that over the past 10 or 12 years collectively the additions to gas reserves have been nearly double total production.

The half left unsaid is that in 1946 total reserves were 32 times annual production whereas in 1960 they were only 20 times production. That doesn't add up to "more than keeping pace."

Another AGA half-truth is that last year again we found more gas than we produced. We did—by one measly trillion feet. AGA's own figures show that in 1960 the U. S. produced 13 trillion and found 14 trillion—the smallest net increase in modern history.

To supply AGA's rosy predictions of increased gas sales over the next decade, reserves must increase by some 25 trillion feet per year. The truth is that we have never found that much gas in any year. The average of the last 15 years is 16½ trillion.

Yet AGA says "there is no foreseeable supply limitation which would affect the gas industry's ability to expand . . . Sufficient gas will be found to keep the gas industry in business for decades to come." That is utter hogwash.

SUFFICIENT GAS won't be found to keep the business expanding at its recent rate unless there is a big stepup in exploration for it. This will cost money. And because the oil market is stagnant, a much larger portion of exploration funds must come from producers' prices for gas.

Major gas pipelines realize this, so they are now offering higher field prices for new contracts in order to get future supplies to expand their sales and their customers' sales.

But AGA's members and their political allies fight every increase in field prices and every regulatory or legislative change that might permit prices high enough to encourage the search for new supplies.

AGA is creating a fool's paradise by propagating the notion that consumption can increase indefinitely with no concern at all about supply.

JAL SUPPLY

MAC
RE

Jal-Con-Weld "50"
High Strength
High Performance
Low Price

ARONI PORT

Why has Jal-Con-Weld "50", the original high strength welded macaroni tubing from Jones & Laughlin Supply Division gained wide acceptance in record time?

Because Jal-Con-Weld "50" offers a 50,000 pound psi minimum yield strength, yet is priced well below conventional high strength tubing.

Call your local J&L Supply man for all your macaroni tubing requirements, or write us at Tulsa, 1439 South Sheridan Road.

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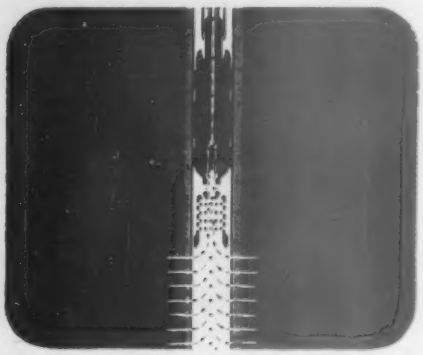
"SPECIALIZED"

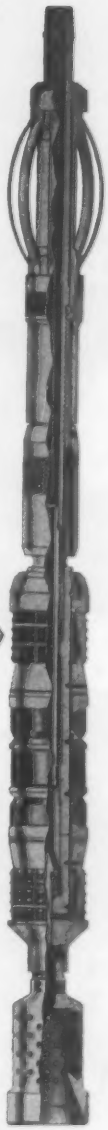
SQUEEZE CEMENTING with HALLIBURTON TOOLS



Squeeze Cementing and Bridge Plugging operations have a history of success in thousands of wells—in a multitude of various applications—in most all types of formations... extending the natural producing life of oil and gas wells and employing a conservation program of natural energies for oil production economy.

Specialized Halliburton tools and equipment, offers flexibility in cementing operations which can help accomplish many special purposes and help solve many special remedial problems.

Here are some *specialized* Halliburton drillable packers that permit maximum flexibility in application for a higher ratio of remedial success in producing wells:



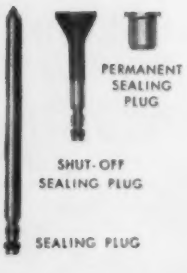
"DM-DC" DRILLABLE SQUEEZE PACKER/BRIDGE PLUG WITH CIRCULATING VALVE... the industry's most versatile tool for either squeeze cementing, or as a bridge plug!

For general application in any well, regardless of depth or pressure... effects a positive fluid shut-off from either direction... of simple design and easily run in and set on tubing, drill pipe, drilling or sand line.

Type "DM" is constructed of high strength "drillable magnesium alloy" for squeezing or temporary bridge plugs... type "DC" is made of "drillable cast iron" for squeezing or permanent bridge plug and may be used as a temporary bridge plug when desired.

The "DM-DC" Drillable Squeeze Packer is easily converted into a bridge plug by dropping a Sealing Plug through tubing into the packer or installing a Permanent Sealing Plug before running tool into the well... Shut-off Sealing Plug may be pumped down through 2" or 2½" tubing and shuts off in the packer. The rubber cup helps to prevent contamination between fluids.

OPEN HOLE "DM-DC" DRILLABLE Squeeze Packer with the addition of an extension mandrel and a long rubber seal element. Used extensively in hard open hole formation near to true bit size, and has been set in depths of 11,000 ft. holding pressures up to 5,000 psi. Simple setting procedure is the same as in the regular squeeze packer and bridge plug but cannot be set by any type of setting tool run on a wire line.



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Libya May Set New Operating Pattern

• New company apparently plans to give Libyan partners a controlling interest. In the future, companies seeking exploration concessions may first be required by government to take in Libyan partners.

Who's Involved in New Libyan Company

D. D. Feldman

Anis Qasim

Dr. Nadim Pachachi

PRINCIPALS in the National Oil Co. of Libya, which may change the operating pattern in the country, include:

Oil operators . . . Kewanee Oil Co. Tulsa, and Libyan Desert Oil Co., Dallas, a D. D. Feldman enterprise.

Libyans . . . "Prominent" Libyans who have not yet been identified. However, a consulting firm which includes Anis Qasim, a member of Libya's first petroleum commission has been linked with the venture. Dr. Nadim Pachachi, an Iraqi employed by the Libyan Government a few months ago as special oil consultant, is being given credit for organizing the venture.

Co-ops . . . The big Swedish cooperative, Sverifes Oljekonsumenters Riksforbund; International Oil Producers, Inc., a group including Central Bureau of Rotterdam; International Cooperative Petroleum Association.

And three American co-ops—Texas City Refining, Inc., National Cooperative Refinery Association, McPherson, Kans., and Cooperative Refinery Association of Kansas City.

THE NEWEST entry in Libya's oil sweepstakes is a company with a Libyan national veneer, the financial backing of American and European cooperatives, and the knowhow of two American oil independents.

Corporate papers for the new National Oil Co. of Libya are expected to be filed in Tripoli early next month.

The venture will have Kewanee Oil Co., Tulsa, as operator. "Prominent," but as yet unnamed Libyans, will apparently have control. Cooperatives ranging all the way from Stockholm to McPherson, Kans., have an interest in the new company. And Libyan Desert Oil Co., Dallas—a D. D. Feldman enterprise—also has an interest.

Almost no details were being divulged last week. But it is obvious that the new company has the blessing, if not the actual backing, of the Libyan Government. Principals involved are serenely confident that the company will be granted exploration acreage in the world's current hot spot for oil.

If the company, set up as it is, does acquire oil concessions in Libya, it could set an entirely new pattern for future operations in that country. It could well mean that Libya may insist in the future that any applicant for exploration acreage take on Libyan partners first.

Such a "nationalist" ideal has been growing in the North African country at an almost incredible rate

since oil was first discovered there less than 5 years ago.

A brief announcement naming the American and European cooperatives and the two American oil companies as participants in the venture only confirms industry rumors that such a diverse group was getting together to form a Libyan company. None of the Libyan interests in the new company have been identified, but the name of Mustafa ben Halim, former premier of Libya, has been mentioned repeatedly in connection with the venture.

Ben Halim stepped out of active Libyan politics when he went out of power late in 1957, but he has since been a powerful behind-the-scenes political figure with an active interest in oil. A few months ago he and Anis Qasim, a member of Libya's first petroleum commission, and Jack Tappan, former U. S. ambassador to Libya, formed a consulting firm to do business in Libya with emphasis on oil.

Ready-made markets . . . The interest held in the new company by cooperatives, especially European co-ops, would give the company ready-made markets for any crude it might eventually find in Libya. This requirement is fast becoming just about as important as finding oil.

The big Swedish co-op involved, Sveriges Oljekonsumenters Riksforbund, markets about 40,000 bbl. daily in Sweden and at least 30% of its supply is Russian oil.

The Dutch co-op involved, Central Bureau of Rotterdam, is active in the Netherlands marketing picture and International Cooperative Petroleum Association is affiliated with a cooperative group that is very active in the United Kingdom.

The three U. S. cooperatives involved would not have as wide open a market field as the Europeans for any Libyan crude the company might find. But each could acquire an import quota equal to 9% of its refinery input. Figures just released by Washington indicate that the refinery input of the American co-ops in the past year amounts to 31,230 bbl. daily for Texas City refining; 28,007 bbl. daily for National Cooperative Refinery Association, McPherson; 34,664 bbl. daily for Cooperative Refinery Association of Kansas City.

Libyan political climate . . . The Libyan climate is ripe for a venture which gives Libyans control.

In the brief period since Libyan oil play started, the Libyans have become increasingly dissatisfied with the way private companies operate in their country. This is in spite of the fact that private companies are just about to put Libya on the map as a major oil producer and start pouring oil revenue into an almost non-existent national treasury.

Government restrictions on almost every phase of oil-company operations have increased almost weekly in the past 2 years. Import permits for machinery are hard to get. Almost any action a private oil company wants to take is viewed with suspicion and distrust by Libyan officialdom.

With more outside money pouring into the country than ever before in its history, Libya demands more all the time.

Acreage available . . . Under Libya's oil law, the 20 private companies which have exploration acreage under concession are required to turn 25% of each block back to the government at the end of the initial 5-year term. This relinquishment is already in progress, making additional acreage available.

By the first of this year, at least eight new companies had turned back a total of almost 35,000 sq. miles of territory—much of it after a quick and cursory exploration program. As of last May, 45% of the original acreage granted in Libya was subject to this one-quarter turnback provision of the law. Another round is due in December.

Some of the blocks affected by the acreage turnback were Esso's big Zelten area and the block on which Oasis Oil (Ohio, Continental, and Amerada) has established Libya's major oil fields.

If the new company—as is being widely assumed—has the backing of the Libyan Government it can virtually take its pick of this relinquished acreage. And if the new company does obtain Libyan acreage this easily, any other company interested in applying for some can surely expect pressure from Libyans to follow its pattern and take on Libyan partners.

Gulf Offers

GULF Oil Corp. is waging a vital marketing battle in San Antonio where it is meeting the independents head on in price and quality with an economy Gulf-branded gasoline.

The company's big weapon is Gulftane, a gasoline of about 90-octane, priced dead even with the product sold by the private-brand independents and price cutters.

Gulf's regular normally is about 2 octane numbers and 2 cents higher.

Gulf is using the economy gasoline as a third grade by eliminating in the San Antonio stations its superpremium Gulf Crest. It is retaining the regular and premium grades.

Other majors kept a close eye on San Antonio last week. They participated in the wild price gyrations that accompanied the Gulf move. But they gave no indication they were preparing to follow by installing new low-priced products of their own.

Test fight . . . Marketers say the implications at San Antonio could be far reaching and could rank the city with Charlotte as an important marketing test spot.

At Charlotte, a violent price war broke out recently among majors and independents after Sun Oil introduced two low-priced, low-octane blends on its multigrade pumps. The blends also were aimed at meeting independents in price and quality.

At the same time Sun filled in a high-octane spot in the pump-blending apparatus, allowing its Charlotte stations to offer nine grades—from an economy grade to a superpremium.

Gulf only markets three gasoline grades and so elected to meet the independents with two grades at the low end of the octane scale and let Gulf Premium satisfy the autos requiring high octanes.

Between the Charlotte and San Antonio tests, marketing executives believe this pattern is taking shape in the battle for the motorist's patronage:

. . . Majors more and more are deciding to meet the independents on price and perhaps quality.

This is recognition that the independent retailers in the last few

New Low-Octane Regular

years have been taking a larger share of the gasoline market at the majors' expense.

...An economy brand at major stations—such as Gulf and Sun are offering—may emerge.

This will meet the independents on price and quality and still permit the major stations to protect the price of their higher-grade products and services.

...Price spread between major and independent stations may narrow to 1 cent. This downward pricing move may well be the answer the major firms take who don't care to start marketing a new economy grade but prefer the traditional two grades of gasoline.

This 1-cent spread has developed on the West Coast and appeared in the San Antonio price war following Gulf's introduction of Gulftane. Cuts of up to 10 cents per gallon were posted by independents in various parts of San Antonio and surrounding country. The price of Gulftane followed but never led in the cuts. Other majors kept their regular 1 cent above the independents and Gulftane.

...Double standards of marketing may be pushed by the majors.

A few majors already are marketing products under a low-cost private brand at independent stations while selling at major prices at their own brand stations.

Some major marketing executives are considering another approach to the same idea. They may start experimenting with speed stations which will market nothing but branded gasoline and motor oil and specialize in fast service at lower prices. At the same time these majors will maintain their larger stations with wash and grease bays, offer TBA sales, give minor repair services, and get a larger margin on gasoline.

Full plans secret . . . Gulf's marketing officials in Houston shed little light on ultimate plans for Gulftane except to admit that it is experimental.

Gulf's full statement:

"A new grade of gasoline has been introduced in the San Antonio area by Gulf Oil Corp. on an experimental basis. The new product, named Gulftane, is designed to fulfill the needs of many cars on the roads whose engines were not designed to fully utilize today's very high octane gasolines.

"Many motorists will obtain complete performance satisfaction with Gulftane in their tanks while experiencing an added and welcomed economy not heretofore available to them."

Gulf disclosed no octane figures or other information describing the quality of Gulftane.

The big company also declined to speculate whether the experiment in San Antonio was more than local. One competing major said Gulf had lost volume heavily in the past year to independents in San Antonio and may be using the Gulftane device simply to recapture this local market.

But it was equally obvious that if Gulf wins the battle for its old markets in San Antonio by a head-on collision with its lower-priced competitors, the same formula should work in other warmly contested areas.

Operators . . . One leader among service-station operators in San Antonio looked on the Gulf experiment with green-eyed jealousy.

Owner of a competing major station, the operator said frankly, "I wish we were in it, too. I'm ready to go. This is the answer to the encroachment of the independents. The majors increased their volume here 2% last year and the independents 15%." The station operator said he would also like to see the majors move permanently to a 1-cent spread between regular and independent prices—that this, as much as anything else, will give the major operator the increase in volume he needs.

Another sore point with some operators of major stations has been the high-octane superpremium blend, which sells poorly at many locations and touches a much smaller potential market than the lower-octane blend.

Some operators called Gulf Crest a "dud" and point to the absence of a superpremium from the stations of such major marketers as Texaco and Shell as evidence it eventually will disappear.

ATTENDANT at Gulf station in San Antonio admires sign advertising company's new low-octane regular.

Other majors . . . While Gulf's move affects them all, other major marketers were doing little talking for publication.

Humble Oil & Refining Co., which has much at stake in San Antonio and other areas where Gulf markets, said simply that it has no intention of dropping its superpremium gasoline, Golden Enco, but did not comment on the possibility of matching Gulftane on the low side of the octane scale.

Continental Oil Co., also a big Texas marketer, had no comment. However, Continental may be developing another approach toward competing with the independents. It has acquired some independent stations and is using them as outlets for Conoco products. In Houston, for example, the independent-price Kayo brand has made its ap-

pearance reportedly under Continental auspices.

Texaco Inc., the top-Texas marketer, has been one of the toughest competitors in the San Antonio war but said nothing about adding a gasoline equivalent to Gulftane. Instead, in many instances, it simply met the Gulftane price with its regular gasoline.

Independents . . . The chief target of the Gulftane onslaught—the independents—also were reluctant to talk about the war.

But they admitted things were "sticky."

"All we want to do is make some money, and certainly we can't do it at low prices," one leading independent at San Antonio said.

Apparently others in San Antonio are thinking the same thing. Toward the end of last week, prices generally were restored to their "prewar" levels—perhaps even a cent higher.

One independent was asked whether he intended to keep selling at the same level with Gulftane. For the moment, yes, he replied. For the future, no comment.

Steel Plants Using Far More Natural Gas

THE STEEL industry's move in recent years to modernize the open-hearth process increased the use of natural gas in steel plants in a big way.

Natural-gas deliveries to steel plants rose to 324 billion cubic feet annually in 1959, an increase of almost 80% in 5 years, according to E. R. Gardner, district industrial sales manager for Ohio Valley Gas Co., Steubenville, Ohio.

Gardner says refinements made in the open-hearth process indicate the "true potential of the process is just becoming apparent."

Some plants are using natural gas for as much as 70% of their fuel requirements when the gas is used both as a fuel and for atomizing heavy fuel oil.

In a paper presented before the summer annual meeting of the American Society of Mechanical Engineers in Los Angeles, Gardner also pointed out how steel producers are trimming the sulfur content in their products by using low-sulfur content gas.

They're All "Million-Dollar"

Robert J. Enright
District Editor

NOT SO MANY years ago, an operator dreamed of drilling a well which would make him a million.

Now, in some places, he has to have the million to drill the well.

Such a place is prolific Rojo Caballos (Red Horse) gas-distillate field in Pecos County in West Texas' rough Delaware basin.

For sheer expense, drilling in this field rivals the costliest deep-water work in the Gulf of Mexico.

Rojo Caballos now boasts three completions. Total drilling cost: More than $5 million!

All three are owned by Mobil Oil Co., field discoverer.

Mobil's 1 Kathleen Moore, the field discovery, took 405 days to complete and cost more than $2 million.

These are Pennsylvanian wells, with producing intervals ranging downward from about 15,000 ft. in the 1 Moore (Section 19, Block 48, T-8, T&P Survey) to about 16,400 ft. in the latest completion, the 1 Fred Schlosser 1¼ miles southwest in Section 25, Block 49.

The third completion, Mobil's 1 Ivy B. Weatherby, is 1 mile east of the discovery in Section 20, Block 48. Open-flow potentials of these gold-plated gassers range between 30,000,000 and 50,000,000 cu. ft. daily with liquid content of about 28 bbl. per million cubic feet.

Why so costly? . . . Red Horse wells have proved so expensive because drilling there combines the most devilish problems of both West Texas and Gulf Coast operations.

The West Texas hard rock is there. But so are severe lost circulation and very high pressure—headaches frequently encountered in coastal drilling but seldom in West Texas.

In fact, there's nothing quite like Rojo Caballos in West Texas. Bottom-hole pressure was gaged in the 1 Moore above 12,000 psi.—high even for the Gulf Coast and unheard of in West Texas.

Severe lost-circulation trouble plagued Mobil in all three wells down to about 13,000 ft. The company found it virtually impossible to drill with mud through some of these zones. Use of water as the drilling fluid helped.

Then below 13,000 ft., the extremely high pressure zones take over. Mobil figures the pressure gradient at an almost unbelievable 0.86 psi. per foot.

Now a million apiece . . . Average cost of the first three wells runs higher than the expected outlay for a normal Pennsylvanian producer in the field.

For one thing, in each of the three wells Mobil made an attempt to go deeper to look at underlying Devonian and Ellenburger beds. Hole trouble forced the company to abandon the effort in the 1 Moore and 1 Weatherby.

Then, in the 1 Schlosser, completed earlier this month, the bit cut a 1,500-ft. fault. Instead of a projected 18,000-ft. total depth to get a look at the deep beds, Mobil was suddenly confronted with going to at least 19,500 ft. This, with such hazardous drilling, was too much.

So some of the cost of the first wells in each case is due to efforts to go below the Pennsylvanian.

Drilling experience in the field also will help the company cut the costs of future wells. It hopes to avoid such early misfortunes as a blowout in the 1 Moore and sidetracking operations in that same hole.

Even so, the company figures it will cost right at $1 million to drill future Pennsylvanian producers.

Each will require about 825 tons of steel (casing, tubing, etc.) at a cost of roughly $330,000.

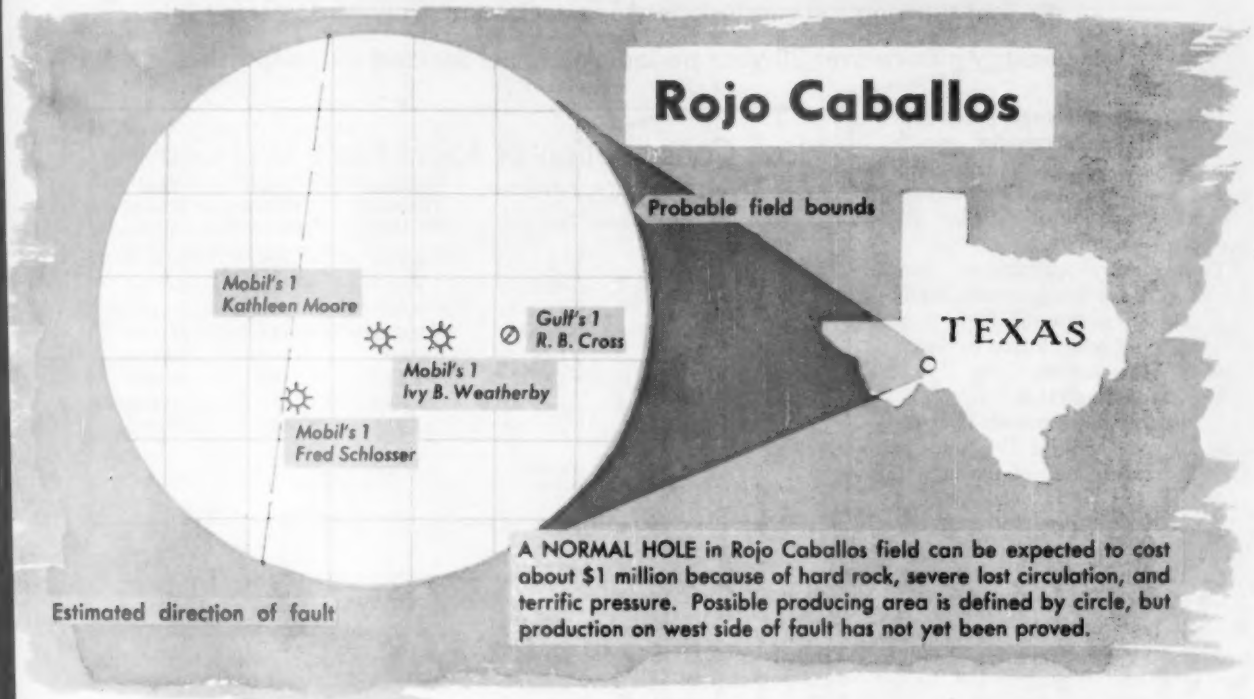
And rig time alone will eat up another $250,000, the company says.

Widest spacing sought . . . To help counter such tremendous costs, Mobil has asked the Texas Railroad Commission to approve the widest spacing ever sought in Texas.

It is asking 1,280-acre proration units, with 10% tolerance and a maximum of 13,000 ft. between the farthermost points of a unit.

This is exactly twice the size of the widest gas units yet approved by

Gas Wells in This West Texas Field


Rojo Caballos
Probable field bounds
TEXAS
Mobil's 1
Kathleen Moore
Gulf's 1
R. B. Cross
Mobil's 1
Ivy B. Weatherby
Mobil's 1
Fred Schlosser
Estimated direction of fault
A NORMAL HOLE in Rojo Caballos field can be expected to cost about $1 million because of hard rock, severe lost circulation, and terrific pressure. Possible producing area is defined by circle, but production on west side of fault has not yet been proved.

the commission — 640 acres with 10% tolerance.

At a recent hearing before the commission, Mobil proposed accompanying rules which would permit a Red Horse well on 1,280-acre spacing to produce at twice the rate of a 640-acre producer.

Doyle G. Marrs, division reservoir engineer for Mobil at Midland, told the commission his studies indicate ultimate gas recovery from the pool would be the same for both spacing patterns. And the higher producing rate on 1,280-spacing, he said, should not result in any well damage.

Mobil spokesmen pointed out that there were no leases in the area smaller than 160 acres.

The Delaware basin, they said, has an enormous potential for relatively deep gas fields. But the problems involved in finding and developing them are likely to be difficult and very expensive ones if Rojo Caballos is an example.

B. O. Sims, Mobil engineer and drilling supervisor, pointed out that Texas has had 640-acre spacing since 1948. "The Railroad Commission," he said, "is in a position now to allow a trial of wider spacing—which should give the Texas oil industry a 'shot in the arm' and still protect against waste."

Feeling the way . . . With drilling costs so high, there is little prospect of any big drilling flurry in Rojo Caballos. Operators will feel their way cautiously, drilling them one at a time.

Only one project is now active in the field. This is Gulf Oil Corp.'s 1 R. B. Cross in Section 21, Block 48, now drilling at about 5,000 ft. It is a mile east of Mobil's 1 Weatherby.

Mobil is expected to start at least one more well before the end of the year. It still intends to probe the deeper prospective pays. But the probe will take place on company acreage somewhere east of the north-south trending fault penetrated by the 1 Schlosser.

With only three wells completed so far, any prediction of areal extent of the field is admittedly a shaky one.

But from available evidence, Mobil hazards an educated guess that it will take in a rough circle of about 30 sections when fully developed (as shown on accompanying map). This is presuming that the area west of the fault will later be proved commercially productive.

In the 1 Schlosser, Mobil penetrated the Pennsylvanian twice. It found that pay at the conventional depth on the east side of the reverse fault, then penetrated a repeat section of the lower Pennsylvanian on the downstream, western side.

This latter section, Mobil says, appears to dip to the west. It showed for gas but appeared also to be somewhat tighter than the equivalent on the other side of the fault.

Gas plant planned . . . Mobil started gas deliveries from Red Horse in mid-June, though its present market is a limited 6,000,000 cu. ft. daily.

The company hopes soon to build a low-temperature separation and stabilization plant to increase gas-liquids recovery from the present 28 bbl. per million cubic feet to about 32 bbl. per million cubic feet.

This depends on approval by the commission of a central separation rule for the field.

Oil, Gas Will Still Dominate 1980's

• That's among top conclusions of Texas Eastern Transmission study on U. S. energy picture over 20-year period. Also: Fuel demand will keep rising.

THE nation's energy needs will continue their spectacular growth over the next 20 years. Petroleum and gas still will dominate the supply picture in spite of big gains expected for electricity.

These general conclusions were drawn in a special economic study of domestic energy and fuels from 1947 to 1980 just released by Texas Eastern Transmission Corp.

The study predicts that:

. . . Energy requirements over the next 20 years will be 2½ times as great as the increase of the last 10 years.

Total end-use need for energy in the United States increased at an average annual rate of 2.9% from 1949-59, rising from 26,200 trillion B.t.u. to 34,500 trillion.

The average growth rate from now until 1980 is projected at 3.1% annually with requirements pegged at 47,000 trillion B.t.u. in 1970 and 64,500 trillion in 1980.

. . . Petroleum and gas will supply 76% of the end-use energy market by 1980, a slight drop from their 79% share of the market in 1959. Coal will decline from 15 to 11% of the market while electricity will climb from 6 to 13%.

Direct use of coal has been virtually eliminated in all market areas except industrial, the report says. The total consumption of coal, however, is expected to increase rapidly in the future due to increasing use in industry and power generation. By 1980 coal will hold 70% of the power-generation market compared to 15% for gas and 7% for petroleum.

In all areas of consumption, by 1980 petroleum will hold 40% of the market, gas 29%, and coal 28%. Waterpower will have only 1% and nuclear sources 2%.

Where energy will be used . . . The industrial sector of the economy is expected to maintain its growth at a faster clip over the next 20 years than any other.

The energy requirements of industry will grow 3.4% per year from 1960 to 1970 and at a 4.2% rate from 1970 to 1980. Over the 20-year period this is an average 3.8% annual growth. In volume, this represents a growth from 14,750 trillion B.t.u. in 1960 to 31,305 trillion in 1980.

By camparison, residential energy requirements will slip from a 3.6% yearly growth rate in 1959 to 2.7% in 1980, transportation from 2.4 to 2.2%, and commercial from 3.2 to 2%.

By 1980, industrial energy will represent 48.6% of the market, transportation 26.3%, residential 20.4%, and commercial 4.7%.

The Texas Eastern study noted these interesting trends in energy requirements:

. . . Residential energy needs have increased more rapidly than population and likely will continue. Population is expected to increase by 81 million or 46% in the next 20 years while the residential energy needs are expected to increase by 72%.

. . . Industry has increased tremendously in the last 10 years the efficiency with which it uses fuel inputs.

For example, if the volume of

How Consumption of Fossil Fuels Will Grow

	Natural Gas Billion Cu. Ft.	Petroleum Thousand Bbl. Daily*	Coal Million Short Tons*	Total Trillion B.t.u.
1949	5,084	5,509	482	29,548
1954	8,206	7,376	388	34,284
1959	11,495	9,036	362	40,490
1960	11,968	9,393	364	41,795
1965	14,687	10,898	397	48,688
1970	17,441	12,271	498	57,070
1975	19,990	13,686	673	67,285
1980	23,146	15,261	885	79,445

*Equivalents based on predicted B.t.u. consumption.
Source: Texas Eastern Transmission Corp.

Expected Demand for Oil and Gas in 1980

• PETROLEUM CONSUMPTION will equal 15,261,000 bbl. daily with major markets consisting of 8,021,000 bbl. daily for motive, 3,793,000 bbl. daily for industrial, and 1,498,000 bbl. daily for residential. The volumes will represent good gains over 1960 except in the residential market where oil actually will lose ground in the next 20 years.

• NATURAL-GAS CONSUMPTION will exceed 23 trillion cubic feet daily with its major markets being 11.25 trillion cubic feet in industrial, 6.8 trillion in residential, and 3.2 trillion in power generation. Gas' big gains over the 20 years will be in the residential market, according to the study made by Texas Eastern Transmission.

goods produced in 1959 had been produced at the 1947 energy input ratio of 71,000 B.t.u. per dollar value of goods, about 12% more energy would have been required. This efficiency has been achieved by the shift from overhead belt drive to electrically driven machines, better insulating materials, and more efficient processes. This improvement in efficiency, however, is expected to slow down in the years ahead which accounts in part for the anticipated stepup in industry energy requirements.

Who will supply . . . The petroleum industry, according to Texas Eastern economists, can expect a domestic market for 15,261,000 bbl. daily by 1980.

The same market was estimated at 9,393,000 bbl. daily in 1960.

Thus the growth rate will be 2.7% yearly in the 1960-70 decade and 2.2% in the 1970-80 period. This is off sharply from the 5.9% annual rate of growth for petroleum in 1949-59.

Gas producers can expect a market for 23.15 trillion cubic feet in 1980 compared to the 1960 market of 11.9 trillion. This also represents a decline in the annual rate of growth for gas. This growth was 8.6% in the 1949-59 decade and will average 3.4% yearly over the next 20 years.

The estimated market for coal in 1980 will be 885 million short tons compared with 364 million in 1960 while electricity will have a market of 2,500 billion kw.-hr. compared with 697 billion kw.-hr. in 1960.

The individual markets for petroleum and gas break down like this:

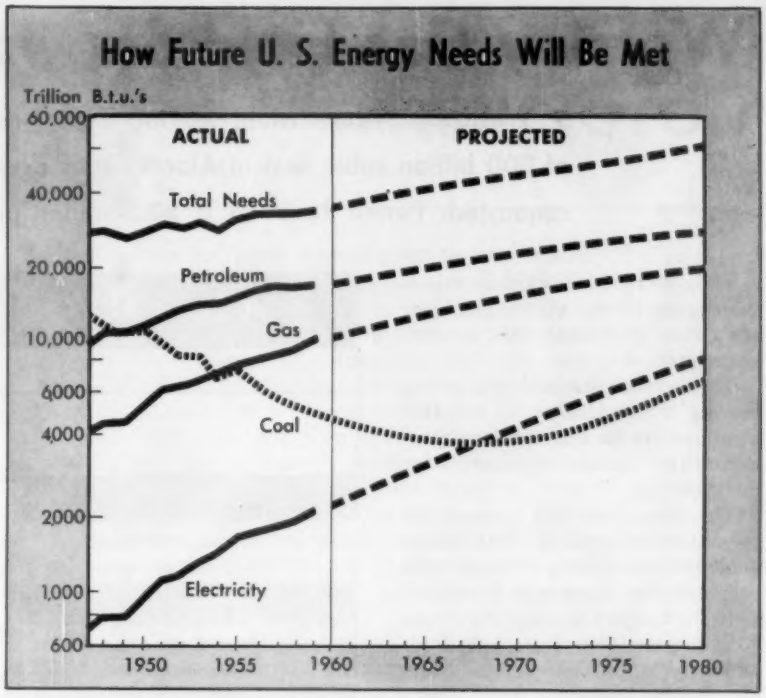
. . . Residential—1,498,000 bbl. daily of petroleum in 1980 compared with 1,556.000 bbl. daily in 1960; and 6.8 trillion cubic feet of gas compared with 3 trillion in 1960.

. . . Commercial—246,000 bbl. daily of petroleum in 1980 compared with 165,000 bbl. daily in 1960; 1.4 trillion cubic feet of gas compared with 1,616,000 bbl. daily in 1960; 11.2 trillion cubic feet of gas compared with 5.9 trillion in 1960.

. . . Transportation—8,021,000 bbl. daily in 1980 compared with 5,082,000 bbl. daily in 1960. While coal was the only other competitor in this segment in 1960 with a market for 3 million short tons, it is expected to bow out after 1965; and petroleum will be the lone supplier.

. . . Power generation—713,000 bbl. daily for petroleum in 1980 compared with 279,000 bbl. daily in 1960; 3.2 trillion cubic feet of gas in 1980 compared with 1.7 trillion in 1960.

. . . Nonenergy and loss—990,000 bbl. daily for petroleum in 1980 compared with 694,000 bbl. daily in 1960; 469 billion cubic feet of gas compared with 272 billion in 1960.



Gasoline outlook . . . The expected yearly growth rate of gasoline faces a nosedive in the next 20 years.

From an average growth of 5% yearly between 1949-59, the motor fuel will experience a growth rate of only 1.9% from 1960 to 1980.

Factors back of this slowup: Rate of growth of vehicle registrations are declining; compact cars with their lower gasoline requirements are assuming a more prominent role; mileage traveled per vehicle is almost stationary; trend in average miles-per-gallon is on the rise; jet aircraft is cutting back the avgas market; competition is growing from diesel and LPG as motor fuels.

The use of jet fuel, the report said, is expected to increase continuously in the next 20 years, initially at the expense of avgas. Military use of jet fuel, however, is expected to level off after 1965 as the displacement of conventional aircraft approaches completion and as rockets and missiles become standard elements of the military program.

About the study . . . Texas Eastern undertook the comprehensive study with three aims in mind:

. . . To provide an integrated and systematic means by which the structural relationships between energy and fuels may be analyzed.

. . . To estimate the consumption of fossil fuels in various markets.

. . . To provide a point of departure from which to develop related studies.

The researchers noted that within the next 20 years advances are likely in nuclear power, fuel cells, and other new concepts. But it reported the best judgment at present suggests that of these, only nuclear power will provide measurable competition with the fossil fuels by 1980, and this will not be substantial.

The 80-page report is available to anyone interested at Texas Eastern offices in Houston.

Worsley Gas Field Shows Big Promise

• Westcoast Transmission, seeking export authority, says estimated reserves of 300 billion cubic feet in Alberta reef development may be tripled. Also requested: Permit to build a $2.5-million pipeline for getting gas out.

THE WORSLEY FIELD area is shaping up as one of western Canada's most promising new natural-gas regions.

This was emphasized at a recent hearing of the Alberta Oil and Gas Conservation Board on related gas-export and pipeline applications for the area.

The board was told that current estimated reserves of 300 billion cubic feet are conservative, and that eventually the figure may be tripled.

In the Calgary hearing, Westcoast Transmission Co., Ltd., asked for authority to add Worsley field and the nearby Boundary Lake South area to fields covered by an existing export permit.

Alberta Gas Trunk Line Co., Ltd., sought permission to build a pipeline which would move gas from the two areas to a meter station near the Alberta-British Columbia border. The gas would be delivered to Westcoast.

Although the Worsley D-3 reef was discovered by Shell Oil Co. of Canada in 1959, the hearing marked the first public disclosure of its current status and its prospects.

A Look at Worsley's Gas Reserves

(Millions of cubic feet)

	Initial Gas in Place	Initial Recoverable Wet Gas	Initial Disposable Dry Gas
Worsley Field			
Proved reserves	290,570	246,990	234,640
Probable additions	103,910	88,330	83,920
Boundary Lake South			
Proved reserves	11,580	9,850	9,450
Probable additions	16,640	14,150	13,580
Totals	**422,700**	**359,320**	**341,590**

SOURCE: Westcoast Transmission Co., Ltd.

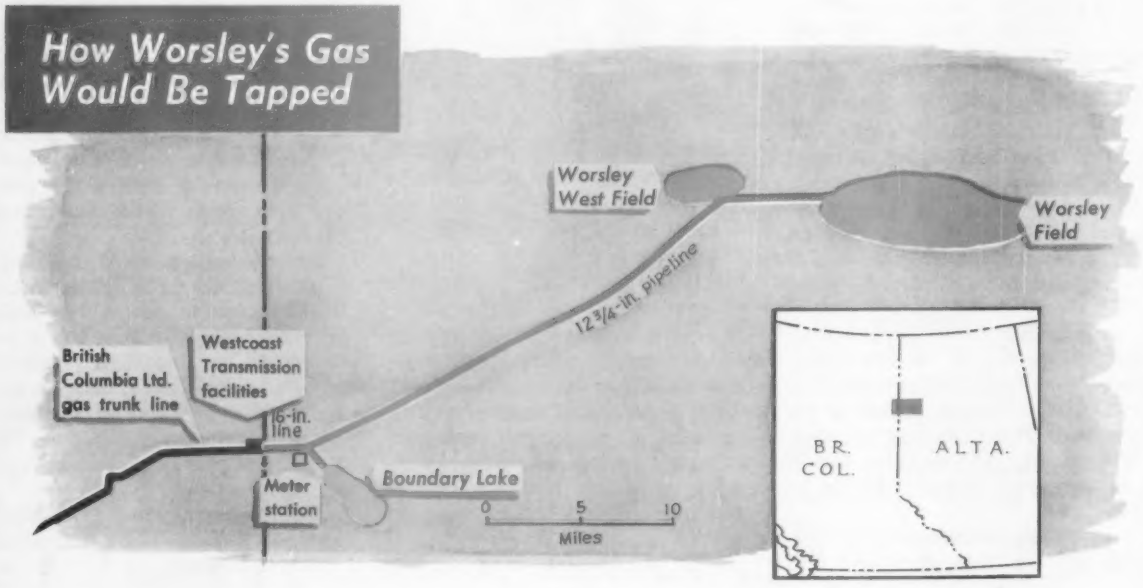
Figures presented to the board estimated gas reserves in place for Worsley at 290,570,000 M.c.f., while in-place reserves for Boundary Lake South were put at 11,580,000 M.c.f. That totals 302,150,000 M.c.f.

Dr. G. S. Hume, vice president and chief geologist of Westcoast, said he thought "substantially more" reserves will be found in this most northerly D-3 reef development of Alberta.

Pressed, he said reserves should be "two or three times more" than current estimates.

The board also was shown two

How Worsley's Gas Would Be Tapped



proposed gas - purchase agreements that gave an indication of expected reserves.

One agreement between Westcoast and Shell covers a projected 400 billion cubic feet of recoverable reserves at Worsley. The other proposal is a gas-purchase pact between Westcoast and Pan American Petroleum Corp. and Imperial Oil Ltd., for Boundary Lake South reserves of 85 billion cubic feet.

The applications . . . In its application for export approval, Westcoast told the board that gas from Worsley and Boundary Lake South is needed to meet demands of the company's customers in British Columbia and in western U. S. market areas.

Westcoast stressed that the gas to be purchased in these areas is surplus to current and future requirements of Alberta and the rest of Canada (exclusive of British Columbia).

The Alberta Gas Trunk pipeline application calls for a 12¾-in., 38.6-mile line starting near Shell's Worsley 10-22 in LSD 10, 22-87-7w6. Just before entering the proposed meter station near the Alberta - British Columbia border, a connection would be provided for gas from Boundary Lake South. A 16-in. line from the meter-building site would run westward 2.2 miles to a point ½ mile east of the border, and there the line would tie in to Westcoast facilities.

Total cost of the Alberta Gas Trunk project is estimated at $2,571,937. At first the system would deliver 68.8 million cubic feet daily—53.4 million cubic feet from Worsley and 15.4 million cubic feet from Boundary Lake South.

Area's history . . . Worsley field has been a one-company operation by Shell. The discovery well, Shell Worsley 14-19 in LSD 14, 19-87-7w6, focused attention on the area.

Five capped Shell Worsley wells are capable of production now. Another Shell Worsley well has been classified as an oil well.

Two Permo - Pennsylvanian gas wells have been completed in the Boundary Lake South area: Imperial-Pan Am Floral 10-20 in LSD 10, 20-84-12w6, and Pan Am A-1 Floral 14-31 in LSD 14, 31-84-12w6.

Watching WASHINGTON

Clyde La Motte

• Is it better to have nonoil men in government? . . .

JOHN KELLY, assistant secretary (for minerals) of Interior, is inclined to the view that the industry is falling down on the job of providing qualified men for government oil-related posts.

Right now Interior is searching for two men, one to be director of the Office of Oil and Gas and the other to be oil-imports administrator. And the industry hasn't been of much help.

The OOG spot has been open for months and Kelly has tried repeatedly to get the industry to suggest likely candidates. He thought the problem was solved when Edgar Kraus of Atlantic Refining Co. indicated willingness to accept the assignment. However, when word circulated that Kraus was about to be named, some segments of the industry objected on the grounds that Kraus was a major-company man. As a result, the appointment of Kraus has been delayed and now appears unlikely.

Kelly's concern: If the industry fails to provide good men for the OOG and imports posts, the administration will have no recourse but to select nonoil men.

• Another probe of oil controls is being readied . . .

THERE will be an announcement soon on plans for a hearing on the oil-import-control program by a House subcommittee.

Indications are that the hearing will cover a wide range of issues, including import quotas for inland refiners, and that it will last 2 weeks or more.

The subcommittee staff has been working on a detailed questionnaire to send to refiners. In first draft this was a lengthy, detailed form, but efforts are being made to trim it down to manageable size. Even so, refiners will groan with protest.

Rep. Tom Steed (D.-Okla.), subcommittee chairman, said the main purpose of the hearing—and the questionnaire—is to develop solid facts and figures about the import-control program. This, he feels, would provide a solid basis for evaluating the program's effectiveness—or lack of it.

Steed insists this is a fact-finding expedition only and that one useful byproduct could be development of a better understanding in Washington circles of the importance of maintaining an adequate supply of domestic oil.

• Wanted: A prime contractor for Mohole project . . .

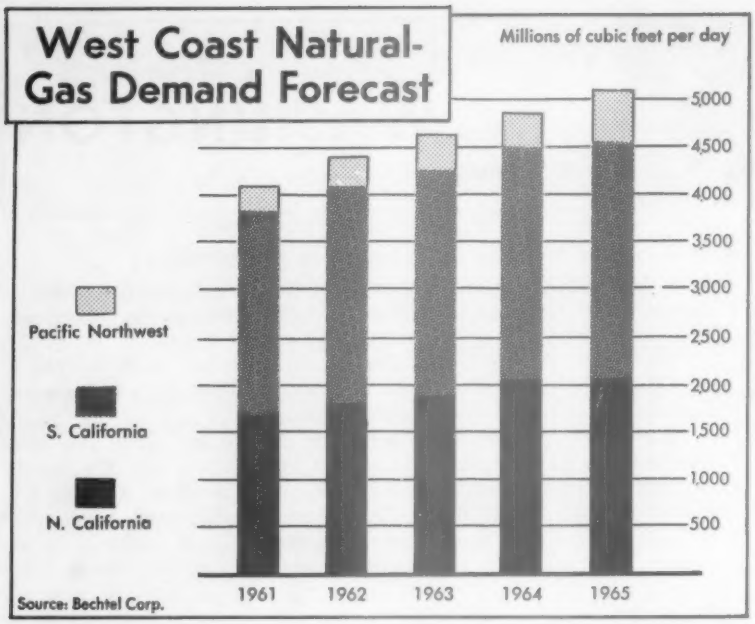
THE MOHOLE project, a fascinating undertaking aimed at penetrating the earth's inner crust, needs a prime contractor to direct the effort the rest of the way.

The scientific groups who directed Mohole through its initial stages feel that from this point on it would be better to put the work in the hands of a private contractor.

The contractor would have responsibility for conducting deep ocean surveys, designing and constructing deep-drilling equipment, and drilling a series of deep holes in the ocean floor.

As a start in that direction, the National Science Foundation is holding a briefing in Washington July 27 for representatives of companies who might want to become the contractor.

Purpose of the session will be to give information on what has been done and on what remains to be done if the objectives of the project are to be realized.



Gas Demand May Jump 25%

THE booming West Coast natural-gas market is expected to grow by about 25% during the next 4 years.

A Bechtel Corp. survey made for Westcoast Transmission Co., Ltd., predicts the average daily gas requirement for California and the Pacific Northwest will pass 5 billion cubic feet by 1965. Present demand is slightly more than 4 billion cubic feet daily.

Westcoast is particularly interested in the area because it delivers gas from British Columbia and Alberta fields to the El Paso Natural Gas Co. pipeline system at Sumas on the Washington-British Columbia border.

Deliveries have been about 225,000 M.c.f.d. El Paso can take up to 300,000 M.c.f.d. from Westcoast under their present contract.

El Paso Natural, which had the big California market all to itself until Transwestern Pipeline Co. recently moved in, supplies about 60% of the U. S. Pacific Coast gas requirement from fields in Canada, Texas, New Mexico, and Wyoming.

Westcoast is confident it will get its share of the increased U. S. business because:

. . . **El Paso Natural** owns gas reserves in Canadian fields which the Canadian transmission firm serves.

. . . **The Canadian** Government has pledged it will give "primary consideration" to the Westcoast system when future gas-export licenses are issued.

A Westcoast Transmission report shows the 1960 drilling season in northeastern British Columbia and northwestern Alberta resulted in the discovery of 1.454 trillion cubic feet of new gas reserves. This boosted total estimated reserves in the area served by Westcoast to more than 7 trillion cubic feet.

SunOlin Laying 10 Product Lines Across Delaware River

TEN pipelines are being strung across the Delaware River from the growing SunOlin Chemical Co. complex near Claymont, Del., to customer plants near Pennsgrove, N. J. The 10-mile system will cost $4,200,000.

Seven of the lines are already designated for specific products. The other three are hedges against expanded shipments or new products. Their installation with the others will be much cheaper than if they were handled as separate projects.

Petrochemical pipelines . . . Sun Oil will lease two lines from SunOlin.

One will be a 4-in. line to transport propylene to the Shell Chemical Co. polypropylene plant now going up near Woodbury, N. J. The second, a 6-in. line, will deliver Sun gasoline and heating oil to the Paulsboro, N. J., terminal.

Two other 4-in. lines will carry hydrogen and carbon monoxide to the Du Pont Co. anhydrous-ammonia plant at Deepwater, N. J. A 6-in. line will carry ethylene to Du Pont and Shell.

Air Reduction Sales Co. will lease two lines. An 8-in. line will carry nitrogen from Airco's planned plant adjacent to SunOil, and a 6-in. line will carry oxygen to industries across the river. The oxygen line will be fabricated from stainless steel.

Pipeline construction . . . The 10 pipelines will be laid in a 25-ft.-deep trench extending 6,000 ft. across the river bed.

Sediment dredged from the bottom will become fill for low sections on the Sun industrial site on the New Jersey shore.

To anchor the lines and protect them from traffic along the busy section of the river, Sun will fill the trench with sand and gravel. The lines will be coated with a heavy asphalt mastic. The submarine portions will be jacketed with concrete for extra weight and to safeguard against mechanical damage.

Offices to Have Gas Turbines

NATURAL-GAS turbines will generate electricity for two new Northern Illinois Gas Co. buildings.

The utility plans to erect offices near Aurora, Ill., and at Glen Ellyn, Ill.

Both will have self-contained systems for production of all electrical needs.

AiResearch Manufacturing Division of Garrett Corp., Phoenix, Ariz., is designing two natural-gas turbines for the 50,000-sq.-ft. Glen Ellyn structure.

Take a new look at antiknocks

The wide range of lead alkyl antiknocks now available, and their increased cost effectiveness, make it even more important to re-examine process vs. antiknock balance.

■ Costs of Research octane number per barrel from antiknock compounds have been reduced. This reduction makes increased use of antiknocks a more attractive route toward the most economical production of gasoline.

■ Over and above the lower octane improvement costs, lead antiknock compounds provide an important road performance bonus. This bonus can come from antiknocks alone and will increase as lead concentration increases.

Ethyl's trained technical personnel stand ready to assist you in deciding on the proper selection and use of the most effective antiknock compounds for you. Your Ethyl Representative will be glad to supply you with the necessary information or technical assistance.

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Tenneco Has New-Type Station

TENNESSEE Gas Transmission Co. is bidding for its home-city gasoline market at Houston with a newly designed service station that places the wash and lubrication bays in the rear and five vending machines in a lounge area at the front.

Tire, battery, and accessory displays also are located at the front, but are not in the way of the station operator.

Tenneco Oil Co., TGT's marketing company, recently introduced its Tenneco brand at major prices. It is gradually replacing its independent-priced Bay-brand stations with the upgraded product and improved facilities.

The company is building 10 stations in Houston. At present it is operating about 850 stations from Massachusetts to New Mexico. It hopes to have some 1,100 stations by next spring, and nearly all these will be displaying the red-white-and-blue Tenneco shield.

The new T-shaped station design will be basic for newly built stations. The prototype at Lake Charles, La., is shown above.

By placing wash and lube facilities behind the sales office, Tenneco avoids congestion in the driveway, permits the entire front to be used for gasoline and TBA sales, and gives the station a more attractive appearance.

Coin-operated machines dispense, candy, hot coffee, hot and cold foods, soft drinks, and cigarettes.

Texas Sets Date for Oil-Gas Lease Sale

BIDS for oil and gas leases on 187,508 acres of Texas school, parks, and prison lands will be opened at Austin August 1.

The lands include more than 8,000 acres in the controversial "Padre Island National Seashore" area. There are a dozen of the "seashore" area tracts ranging from 640 to 914 acres in the Laguna Madre adjoining Padre Island, Kenedy County.

Jerry Sadler, Texas land commissioner, has been an outspoken advocate of continued minerals development in the area if the surface is dedicated to park purposes. He said the Laguna Madre tracts were offered at the request of prospective bidders.

Other state school lands up for lease include 30,000 acres in the Gulf of Mexico off Aransas, Calhoun, and Kleberg counties; more watery tracts in bays and rivers; upland acreage mostly in Culberson and Reeves counties in far West Texas.

Prison and park lands include a block of 7,439 acres on the Ramsey State Prison Farm in Brazoria County and a 152-acre tract in Lake Stamford State Park, Haskell County.

Government Files Antimerger Action Against LPG Firm

THE Justice Department made another antimerger move last week—this one against a California company selling liquefied-petroleum gas.

The Government is charging that Suburban Gas of Pomona has been acquiring competing LPG firms rapidly in recent years, thereby tending to destroy effective competition.

This was the acquisition picture the federal attorneys drew:

In May 1960 Suburban acquired the Calor Co., a big firm selling LPG to retailers and industrial consumers in Washington, Oregon, and California.

From October 1954 to May 1960 Suburban bought eight firms with 26 LPG plants in Oregon and 20 in Washington.

In a series of purchases beginning in December 1953 Suburban acquired five firms with nine plants in Arizona.

The Government complaint charged that these acquisitions "tend to create a monopoly for Suburban Gas in the sale and distribution of LPG."

"Suburban has publicly announced its intention to actively continue its policy and practice of expanding through the acquisition of other sellers of liquefied-petroleum gas," the complaint, filed in a U. S. District Court in Los Angeles, said.

The Government noted that in the fiscal year ended last April 30 Suburban had sales of $13.5 million.

Here is what the Justice Department wants done:

... **Divest Suburban** of Calor Gas Co., setting up a new, independent corporation to handle the business and assets acquired from Calor last year.

... **Restore "effective"** competition by requiring Suburban to also divest itself of all interest in or control over such business, properties, and assets of corporations "unlawfully" acquired in Oregon, Washington, and Arizona.

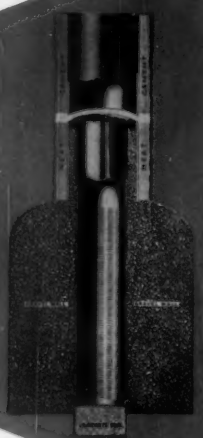
... **Enjoin Suburban** from making any further acquisitions without court approval.

Layne
SINCE 1882

Layne Vertical Turbine Pumps are designed, engineered and manufactured by Layne in Memphis, Tennessee and nowhere else. Because pumping needs vary, there is a Layne pump for every pumping requirement—from 30 to 100,000 G.P.M. in sizes from 4 to 42 inches. Layne Pumps include Deep Well and Short Coupled (oil or water lubricated), Propeller, Mixed Flow, Regular and "In-Line" Submersible. For additional information write for bulletins 200-oil lubricated or 201-water lubricated.

has the only complete service that means

Water



The Layne Gravel Wall Well is an example of Layne experience, engineering and research. This gravel packing and 134 shutter screen employment affords larger screen openings, reduced friction, reduced draw down and pumping head. It increases specific capacity and makes for more effective retention of native sands. For additional information write for bulletin 900.

From top to bottom, you can depend on Layne for the most complete water service in the industry. This complete service provides undivided responsibility for the delivery of water . . . of the quality and in the quantity required. Over 75 years of *growing* service gives the skill and technical know-how which makes Layne First in the field of water. For additional information write for bulletin 10.

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Initial Surveys • explorations • recommendations • site selection • foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation • construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research.

Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

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SALES REPRESENTATIVES IN MAJOR CITIES

Way Cleared for Testing Area-Price Approach

• FPC examiner's okay of Shell gas-contract price which exceeds suggested area price is significant move. If commission upholds the decision, it will mean another advance toward value concept of natural-gas regulation.

THE STAGE apparently has been set for a test of just how binding area-price guidelines are on individual natural-gas sale contracts.

A Federal Power Commission examiner last week approved a contract price well above the area price suggested by the FPC last fall.

The sale was by Shell Oil Co. to Panhandle Eastern Pipe Line Co. Initial price approved by the examiner was 20.5 cents per thousand cubic feet.

The gas is from the Elk City field in Beckham and Washita counties, Oklahoma.

In its general policy statement (61-1) issued last fall, the FPC set three pricing areas for Oklahoma: Panhandle, 17 cents; Carter-Knox, 16.8 cents; and "other," 15 cents.

The Elk City field is in the "other" category. As a result, the FPC staff argued in the Shell-Panhandle Eastern case that the area price of 15 cents should apply because the policy statement had settled the issue of initial price.

The FPC examiner, Robert M. Weston, rejected this. He said the commission should not be considered to have determined without notice or hearing the appropriate price for Elk City gas.

The policy statement was meant to provide an approach toward definition of a price line, not an actual determination of that line, he reasoned.

"The decision on any specific case must be in accord with the general direction of evolving commission policy," Weston said. "At present this policy is one of gradualism in applying price restriction to new unconnected gas supplies."

He said the value of gas to pipelines and consumers and the need for new gas by these groups are important factors. At one point in his decision he termed the Elk City field "the most desirable single source of gas available in the United States today."

Size of buy important . . . Weston noted that the very size of the purchase, 701.5 billion cubic feet, tends to put it in a special category.

"In the average case of small reserves or casing-head gas, the FPC can probably at present hold the price line with confidence that such supply will be connected at prevailing area prices," the examiner explained. "Such is not the case here."

"At the outset of effective regulation," he said, "we face the unusual situation in terms of value and need, for which an exception must be made."

Weston obviously felt this case was one in which an exception was necessary.

He pointed out, too, other unusual features of the sale. For example, he said, in the Oklahoma-Texas area it is unusual for a producer to undertake the quality, pressure, and delivery features of Shell's agreement. Most pipelines there take gas at the wellhead and do all gathering and processing.

"The Elk City transaction is to be viewed as one in which Panhandle is paying about 15 cents for gas and about 5 or 6 cents, plus fringe benefits, for the value of its savings in capital and operating outlays for gathering, compression, and processing facilities," Weston ruled.

He conceded there was no guarantee that Shell would not receive a "windfall" from the deal, based on its cost and financial needs. But he pointed out that he was considering value of the gas and not price control on cost or other standards.

"We are in an area where the value of gas is given importance in setting initial prices," he said.

This view, if upheld by the commission, would be another step toward the value concept of gas regulation rather than the utility-type approach tied to costs.

Action's significance . . . Weston apparently was keenly aware of the significance of his action in approving a price that exceeded the "suggested" area price.

"An important breach of existing price ceilings, such as is involved here, is a serious step not to be undertaken without the most careful balancing of all interests," he said.

Other highlights of his decision:

He indicated that geological, not geographical, factors should be considered in determining the proper pricing area to which a particular field should be assigned.

He also upheld Panhandle's plan to deplete the field in 15 years instead of the 22 years the FPC staff had recommended. He said Shell had received five other offers for its gas, all having higher initial prices but covering a 20-year depletion period. Shell, he said, took Panhandle's lower price because of the shorter period, which would mean a faster payout.

The examiner's decision is subject to review by the commission. In view of the unusual aspects of the case, a review is considered likely.

If the examiner's decision is al-

PIPELINE

Almost 300 miles of gas pipeline and compressor facilities with 51,000 hp. have been temporarily authorized by FPC for Texas Eastern Transmission Co. Included are 129 miles of 30-in. north of Kosciusko, Miss., and 165 miles of 20-in. from West Monroe, La., to Kosciusko. The compressor installations will be at West Monroe, 5,000 hp.; Gladeville, Tenn., 15,000 hp.; Danville, Ky., 16,000 hp.; and Berne, Ohio, 15,000 hp.

California's Public Utilities Commission has refused to rehear the Rock Springs pipeline case. Richfield Oil Corp. and Standard Oil Co. of California joined the promoters of a gas line from Texas through Mexico in seeking the rehearing. The appeal now will go to

lowed to stand, Panhandle will construct 150 miles of 24-in. line and 50 miles of 22-in. line at a cost of about $15.7 million to take the Elk City gas. In addition, Panhandle will construct facilities costing about $987,000 to take gas along the Elk City lateral.

Railroad Commission Bans Gas Flaring in Big Nena Lucia Field

PRODUCERS in Nena Lucia field in Nolan County in West Central Texas have been ordered to stop flaring gas by August 1.

A Texas Railroad Commission order prohibits them from producing any oil or gas unless all the gas is turned to legal uses.

The commission said its staff investigation had shown that most Nena Lucia leases are producing far above their legal gas limits. Reports filed by West Lake Natural Gasoline Co., it said, show the company taking 1,001,336 M.c.f. into its system from 381 wells, of which 250 are Nena Lucia wells. The West Lake report showed 272,283 M.c.f. flared.

The order further limits gas gatherers from taking into their systems more than the volume of gas permitted under the field gas limit.

Texas Seeks Gas-Pipeline Tax

• This is the legislature's third recent effort to tap natural-gas pipelines for extra revenue.

TEXAS legislators kicked off a special session last week to raise new money to haul the state budget out of the red and finance new spending programs.

It became immediately obvious that many of them are again looking to the gas industry for a large part of the new revenue.

Rebuffed by the courts in two previous efforts to tax gas pipelines, the legislature — and Gov. Price Daniel—are still determined to pass such a tax that will stand the test of constitutionality.

They may have found one. At least Atty. Gen. Will Wilson thinks so. It is Rep. Bob Eckhardt's bill that would levy a total tax on gas production of 1 cent an M.c.f. Any of this amount over the present 7% of value at the well head now paid by the producer would have to be paid by the "severance producer," who under terms of the bill is usually the pipeline buyer. The bill would raise about $12,500,000 per year over and above present gas-tax income, and Gov. Daniel immediately threw his support behind it.

Wilson's opinion of the bill, labeled HB 4, is that it cannot be declared unconstitutional because it would levy a tax on production. The taxable incidence, he says, could not be pyramided in other states since the gas would not be purchased in other states. It further meets the test of being equal and uniform and treating all alike, Wilson says.

One of three . . . The Eckhardt bill is one of three gas-tax bills introduced during the first day of the session.

The others are an omnibus bill by Rep. Hinson with one portion calling for another type of "severance beneficiary" tax on gas, and another all-purpose measure by Rep. Atwell including a temporary 2-year hike in the gas-production tax to 8% from the current 7%.

All of these bills were quickly referred by the house to its Revenue and Taxation Committee. And the committee scheduled hearings on them for late last week. It hopes to have them ready for action on the house floor early this week.

BRIEFS . . .

the state Supreme Court. The FPC will reopen hearings on the line July 24. The line, which will be supplied by El Paso Natural and Colorado Interstate, was approved once, but amendments forced by California officials require another FPC approval.

Deliveries by Service Pipe Line averaged 848,300 bbl. per day in May—an increase of 54,600 bbl. from its April average, with 35.5% of the deliveries for destinations other than American Oil refineries.

Four 36-in. gas loops will be laid for Transcontinental Gas Pipe Line by C. S. Lenoir Construction. They total 83.21 miles, with 21.46 miles in Walthall, Marion, and Jefferson Davis counties, Mississippi; 12.07 miles in Choctaw County, Alabama; 31.99 miles in Perry and Dallas counties, Alabama; and 17.69 miles in Autauga and Chilton counties, Alabama.

Purchase of Pioneer Gathering System, a 133-mile network of gas-gathering lines in West Texas, by Northern Natural Gas has been announced. Northern will operate the system, which had been owned by Pioneer Natural Gas, Amarillo, under a new subsidiary called Northern Natural Gas Pipeline.

Two construction jobs for Texas Eastern Transmission will be handled by Western Pipe Line. One consists of 17.42 miles of 30-in. gas line from near Wilkesville, Vinton County, Ohio, to a point near the Athens compressor station; the other consists of 12 miles of 30-in. gas line from near Moundsville, W. Va., to Holbrook station in Greene County, Pennsylvania.

Final approval for construction of a 16-mile transmission line in Utah has been granted to Grand Valley Transmission Co. by FPC. The line will transport gas from the Westover field in Grand County, Utah, to a tie-in with the main line of El Paso Natural Gas.

The Tisdale field in Johnson County, Wyoming, will be connected by Service Pipe Line to its North Fork, Wyo., gathering system by more than 9 miles of 4-in. and 6-in. line. Sterling Construction Co., Sterling, Colo., will build the line. The system will give Tisdale crude an outlet to the Casper, Wyo., refinery and to other connecting carriers for movement eastward.

How Southwestern Refinery Runs Shaped Up in May

HERE is a look at southwestern refinery runs in May, as reported by companies to state regulatory agencies.

Oklahoma runs have been discontinued from the Journal's regular report, as figures are no longer available from the state's Corporation Commission.

Arkansas

(Refinery Runs in Barrels Daily)

Company and location—	May	April	May 1960
American, El Dorado	38,972	25,606	41,252
Lion, El Dorado	35,744	34,557	33,361
MacMillan, Norphlet	3,558	2,643	2,084
Other	6,600	6,569	6,112
Total Arkansas	84,874	69,375	82,809

Mississippi

(Refinery Runs in Barrels Daily)

Company and location—	May	April	May 1960
Paluxy, Yazoo City	1,669	1,344	1,216
Pontiac, Hattiesburg	16,311	15,744	14,896
Southland, Sandersville	4,573	3,876	3,542
Total Mississippi	22,553	20,964	19,654

Louisiana

(Refinery Runs in Barrels Daily)

Company and location—	May	April	May 1960
Cities Service, Lake Charles	165,083	165,006	165,025
Continental, Lake Charles	50,088	50,059	55,201
Humble, Baton Rouge	296,263	301,566	316,462
Ingram, Meraux	18,501	19,212	18,443
Shell, Norco	109,502	105,716	106,352
Tenneco, Chalmette	*	22,601	14,309
Other	7,733	7,422	7,733
Total Louisiana	647,170	671,582	683,525

*Not available at press time.

Texas

(Refinery Runs in Barrels Daily)

Company and location—	May	April	May 1960
American, Texas City	145,163	143,066	100,301
Am. Petrofina			
Mount Pleasant	15,530	16,242	13,926
Wichita Falls	8,468	6,098	7,028
Atlantic, Port Arthur	65,462	64,573	65,138
Col-Tex, Colorado City	7,509	7,502	7,985
Continental,			
Wichita Falls	10,013	9,357	6,370
Cosden, Big Spring	28,357	28,995	25,710
Crown Cent., Houston	35,358	31,411	34,927
Delhi-Taylor:			
Corpus Christi	28,100	34,793	32,469
Port Isabel	83	1,968	
Eddy, Houston	1,821	2,063	2,196
El Paso, Odessa	13,186	14,322	13,191
Gulf, Port Arthur	240,018	246,203	257,048
Howell, San Antonio	2,654	2,616	2,016
Humble, Baytown	254,709	290,261	274,154
La Gloria, Tyler	13,616	17,360	15,472
Mobil, Beaumont	226,394	203,667	209,471
Phillips:			
Phillips	69,650	69,063	61,074
Sweeny	58,258	50,023	62,606
Plymouth, Texas City	34,225	35,366	30,834
Pontiac, Corpus Christi	42,251	51,359	46,629
Premier:			
Fort Worth	7,451	7,776	7,683
Longview	2,928	3,146	5,374
Pure, Nederland	80,047	78,175	80,760
Shamrock, Sunray	24,132	17,423	23,307
Shell, Houston	120,914	100,510	92,479
Signal, Houston	54,313	53,779	46,289
Sinclair:			
Corpus Christi	19,263	20,511	27,485
Houston	126,567	126,730	130,103
Skelly, Longview	3,993	3,120	2,876
Southwestern,			
Corpus Christi	25,160	34,251	38,109
Stand. Tex., El Paso	49,660	49,753	50,505
Suntide, Corpus Christi	35,390	33,896	42,514
Texaco:			
Amarillo	10,742	15,619	17,277
El Paso	11,520	11,367	9,611
Port Arthur	243,074	*256,966	266,418
Port Neches	37,254	27,465	43,045
Texas City, Texas City	33,641	33,924	27,451
Other	29,793	28,319	17,537
Total Texas	2,216,667	2,229,038	2,197,368

*Includes condensate

Trans-Canada Adding Gas-Turbine Units

A 53,760 hp. expansion, mainly with remote-controlled gas-turbine-driven centrifugal compressors, will be made on Trans-Canada Pipe Lines, Ltd., by this fall.

The National Energy Board has approved the application for $8,691,500 in new facilities on the 2,340-mile gas line stretching from Alberta to Montreal.

At the remote-controlled stations, no operators will be present, although maintenance personnel for the pipeline district will be headquartered at that location. Stations will be controlled from the Toronto dispatching office.

New daily capacity of the gas line will be 760,000 M.c.f. out of the first station on the Alberta-Saskatchewan border; 453,000 M.c.f. out of Winnipeg, Man.; 416,000 M.c.f. out of Port Arthur, Ont.; 350,000 M.c.f. out of North Bay, Ont.; 176,000 M.c.f. from Toronto toward Montreal; 158,000 M.c.f. from Toronto toward Niagara, N. Y.; and 204,000 M.c.f. from Winnipeg toward Emerson, Man.

The Niagara and Emerson connections are for export to the U. S.

The compressor program includes the following additions to existing stations: 9,660 hp. near Cabri, Sask., raising total available horsepower to 19,129 hp.; 9,580 hp. near Herbert, Sask., raising the total to 18,980 hp.; 9,770 hp. near Regina, Sask., raising the total to 19,348 hp.; 9,680 hp. near Grenfell, Sask., raising the total to 19,360 hp.; 10,070 hp. near Portage la Prairie, Man., raising the total to 20,140 hp.; 2,500 hp. near Ile des Chenes, Man., raising the total to 10,000 hp.; 2,500 hp. near Port Arthur, Ont., raising the total to 10,000 hp.

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Texas "Rigged Well Testing" Probed

THE Federal Petroleum Board at Kilgore, Tex., is investigating complaints that some Texas operators are getting "marginal" status for their wells—with a big boost in oil allowable—by rigging well tests.

In some Texas fields, such a switch from prorated to marginal status will permit an operator to produce from three to four times as much oil per month.

Dan Parvis, chairman of the FPB, confirmed last week at Kilgore that his office is checking into the situation. He said many complaints were received from nearly all corners of the state.

Whether the practice is illegal under current Texas law is uncertain. Purvis declined to comment on this question or to disclose any other details about the investigation or possible FPB action.

Marginal law problem . . . First public disclosure that such manipulation of marginal-well tests was going on appeared more than a year ago in a Journal article on outdated Texas oil laws and regulations (OGJ, Jan. 25, 1960, p. 125).

The key to this particular problem is the Texas marginal-well law.

Under this law, a pumping well in Texas is not prorated after its production falls below a certain volume. This volume is determined according to a depth-bracket formula. An operator gets marginal status when he is able to show, under test, that his well cannot produce more than this set volume.

But there is nothing in the marginal-well statute to require that the well, during this test must produce at its most efficient pumping rate. Producing rates of a pumping well are easily alterable by changing the length of the pumping stroke, the number of strokes per minute, and other data.

The trouble with the marginal-well law stems from its passage at a time when all Texas wells were producing their allowables every day. This was before it was even conceived that the state someday might be on an 8-day producing schedule. And it has resulted in some "absurd" situations.

East Texas example . . . East Texas field offers a good illustration.

There the marginal well may produce 20 bbl. a day every day of the month. But the top allowable for the better wells in the field is only slightly in excess of 20 bbl. a day.

The upshot is that the marginal East Texas field well—the poorest in the field—gets to produce up to 620 bbl. a month, while the best wells in the field (capable of producing thousands of barrels daily) are restricted to as low as 160 bbl. per month. So there is a definite incentive to obtain marginal status in East Texas field.

One company's study in 1960 showed that East Texas field marginal wells represented only 15.45% of total field wells, but produced 23.3% of the field's total allowable.

Is this hot oil? . . . The function of the FPB is to squeeze off production of hot oil. It enforces the Connally Hot Oil Act which forbids interstate shipment of crude oil produced in violation of proration orders of the various state oil-regulatory agencies.

The question involved is whether the added oil that results from manipulation of well potentials so as to qualify for marginal status is hot oil.

Most operators feel it definitely illegal to take some physical action which would alter a well's true potentials. The FPB may well agree.

Import Agency Issues Refinery Input Figures

REFINERY input figures, as compiled by the Oil Import Administration, were made public for the first time last week.

The report was a company-by-company tabulation of refinery inputs on an average barrels-daily basis for the year ended March 31, 1961.

OIA also released figures on District 1 residual fuel oil terminal inputs.

Over-all, refinery inputs were 8,230,992 barrels daily for the year covered by the report, including 7,064,448 in Districts 1-4 and 1,166,544 in District 5.

OIA officials said similar reports would be made covering future 6-month intervals for crude oil and 12-month intervals for residual fuel oil, coinciding with the allocation period for each of these two fuels.

The refinery input figures will give anyone interested an opportunity to note whether a given company increased its refinery runs during a particular period.

The OIA input figures are not entirely inclusive, however. They

Here Are OIA's Input Figures

For Companies With Runs of 50,000 Bbl. or More

Districts 1-4—	Avg. bbl. Daily*
Atlantic	193,226
Ashland	144,296
Cities Service	260,951
Continental	169,471
Gulf	460,680
Hess	60,824
Phillips	219,101
Pure	165,966
Shell	379,317
Sinclair	421,945
Socony	471,042
Std. (Cal.)	195,516
Std. (Ind.)	640,200
Std. (N. J.)	815,631
Std. (Ohio)	133,535
Sun	205,922
Sunray	148,897
Texaco	589,455
Tidewater	109,234
District 5—	
Richfield	153,245
Shell	137,795
Socony	82,457
Std. (Cal.)	313,926
Texaco	66,266
Tidewater	111,116
Union	160,951

*For year ended March 31, 1961.

do not include crude oil imported overland or domestic unfinished oils.

What the OIA figures do include are all domestic and nonexempt crude imports, imported unfinished oils, natural gasoline mixed in crude oil, and plant and field condensates mixed in crude oil which are further processed by other than blending by mechanical means.

Big Products Line Planned to Serve Northwest Refineries

WASHINGTON'S three major oil refineries are to be provided with a pipeline market outlet to the Seattle, Olympia, Tacoma, and Portland, Ore., marketing areas.

Plans for the 324-mile, $17.5 million line have been announced by Texaco Inc., Shell Oil Co., and Magnolia Pipeline Co. Olympic Pipeline Co., owned jointly by the three companies, will operate the line.

Beginning at Mobil's 42,000-bbl. Ferndale, Wash., refinery the line will run south to the Anacortes refineries of Shell and Texaco—with 55,000 and 50,000 bbl. capacity, respectively—and then on down to Seattle and Portland. Products to be shipped will include motor fuels, aviation gasoline, kerosine, and jet fuels.

The line will be made up of 94 miles of 16-in. pipe, 162 miles of 11-in., 45 miles of 8-in., and 23 miles of 6-in.

It's Official Now—NGAA is NGPA

THE Natural Gasoline Association of America has changed its 34-year-old name to the Natural Gas Processors Association. This is the fourth name to be adopted by the association since it was founded.

Known briefly at its beginning as the Association of Casinghead Gasoline Manufacturers, the group became the Association of Natural Gasoline Manufacturers in 1921. The latter gave way in 1927 to the familiar NGAA.

Despite some opinion against changing again, two-thirds of the membership voted for the newest name last March.

Max R. Lents, Houston, NGPA president, says the change reflects industry progress. Other gas liquids outrank natural gasoline in volume produced, and natural-gasoline plants now are in fact gas-processing installations, he says.

Alberta Okays Gas-Liquid Pipelines

HUDSON'S BAY Oil & Gas Co., Ltd., Britamoil Pipe Line Co., Ltd., and Royalite Oil Co., Ltd., have been issued permits to construct recently approved natural-gas-liquids pipelines.

This action by the Alberta Government's Department of Mines and Minerals was taken on recommendation of the Alberta Oil & Gas Conservation Board (OGJ, July 3, p. 73).

A spokesman for British American Oil Co., Ltd., parent of Britamoil, says construction will start right away on the a 64-mile 8-in. Rimbey-Edmonton line.

Royalite has a September-October construction schedule planned for its line, a 26-mile 4-in. extension of its existing system to move Jumping Pound and Wildcat Hills natural gasolines and condensates to the Calgary refining area.

Hudson's Bay is preparing a presentation to be made to the National Energy Board in connection with its Alberta-approved project, the only one of the okayed proposals which involves export facilities.

Also keeping with conservation board recommendations, permits have been denied by the Alberta Government in the cases of Provincial Products Pipe Lines, Hydrocarbons Pipeline, a Westalta-Foothills-Dakota Eastern project, and one of Britamoil's proposed lines.

Processing Briefs . . .

An alkylation unit will be built at the Woods Cross, Utah, refinery of Phillips Petroleum Co. The unit will use a Phillips-developed process. Construction will start late this year with completion scheduled for mid-1962.

A gas-processing plant will be built by Shell Oil in Person field, Karnes County, Texas. The $1.5 million plant will recover 19,000 gal. of liquids and 13 tons of sulfur daily from 16,000 M.c.f. of gas. Shell will own 50% of the plant and be operator, while a 23% interest will be owned by Standard Oil of Texas, 20% by Brazos Oil & Gas, and 7% by others.

A hydrodealkylation unit with design capacity of 1,000 bbl. per day has gone on stream at DX Sunray's refinery in Tulsa. The unit is presently producing 800 bbl. of benzene per day from toluene.

National Petrochemicals Corp., a newly formed company jointly owned by National Distillers and Chemical Corp. and Owens-Illinois Glass Co., will own the 60 million pound linear polyethylene plant being built next to the U. S. Industrial Chemicals plant in Houston. The plant will be operated by U.S.I.

The methanol synthesis unit of the Monochem complex being built at Geismar, La., will be engineered by Vulcan-Cincinnati, Inc. The unit will be designed to produce about 75,000 gal. daily of methanol, and is expected to be in operation during the first half of 1962.

Automatic gasoline blending system to cost approximately $750,000 is now under construction at the No. 1 Cleveland refinery of the Standard Oil Co. (Ohio). The new continuous system is expected to be completed by the end of 1961.

A new gasoline additive has been developed that, according to Standard Oil, division of American Oil, will prevent or remove deposits from carburetor throats. Test fleets had a 6% increase in mileage.

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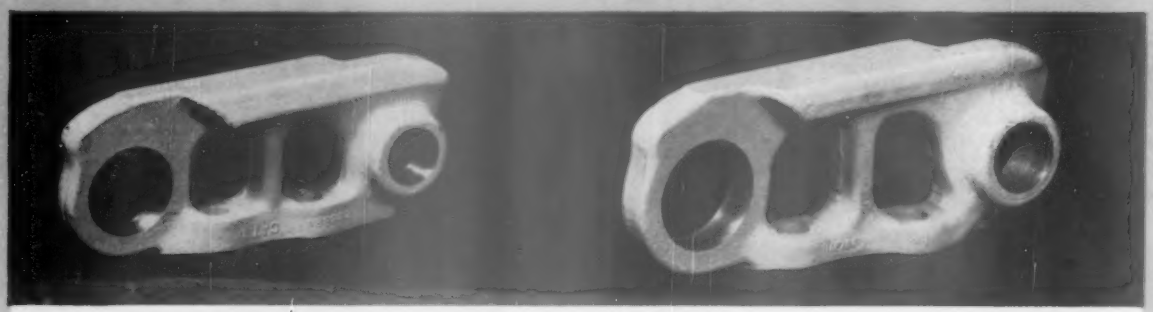

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These new track links are made from special steel, carefully pretested *before* manufacture. They're forged, machined and heat treated to develop maximum strength and toughness. A non-peenable wear barrier is induced *deeply* into rail top and sides by exclusive "Hi-Electro" hardening. This exacting heat treatment permits maximum, file-like wear resistance without brittleness.

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Septuple Completion Expected in Texas

THE rush by Texas operators to compensate for low allowables by getting more allowables for each well drilled is picking up steam.

New world champion in the multiple-completions derby promises to be a Texaco Inc., producer in mushrooming Blessing field in Matagorda County on the Texas Gulf Coast.

Texaco's 1 D. V. McIntosh, if installed according to plan, will become the world's first to produce separately and simultaneously from seven pay zones.

Plans are to complete the 1 McIntosh to produce from two oil pays and five gas zones between 7,020 and 8,553 ft.

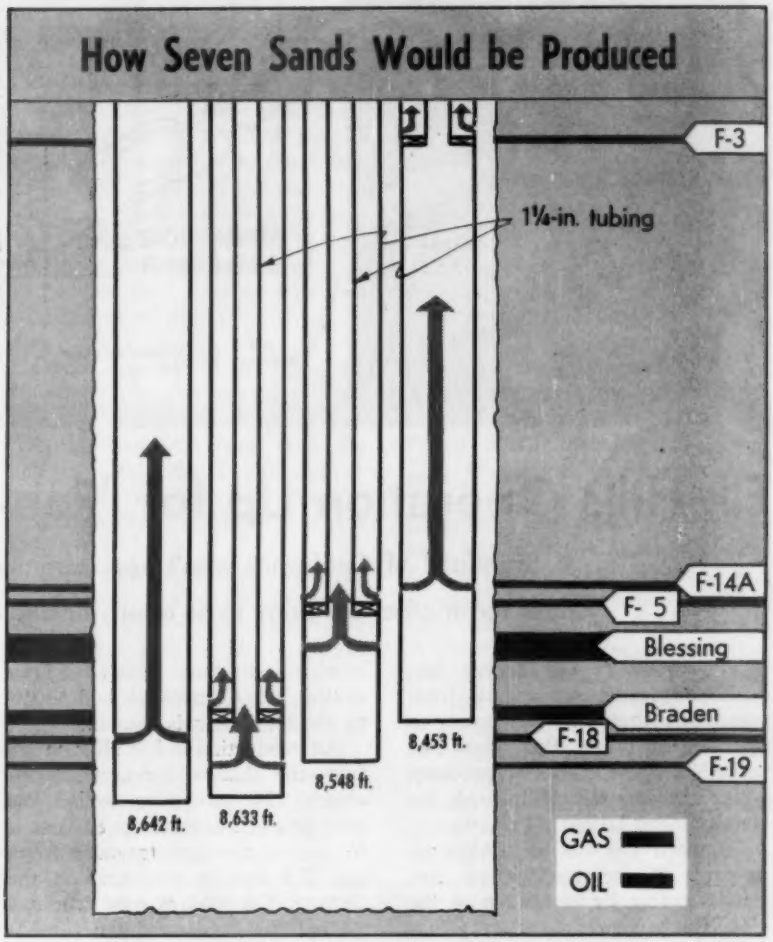
Texaco is awaiting a permit from the Texas Railroad Commission following a hearing July 5.

The proposed septuple completion would produce through four strings of 2⅞-in tubing and three of 1¼-in. tubing inside three of the larger strings.

Perforations are from 7,020-26 ft. in the F-3 sand for oil, from 8,113-19 ft. in the F-14A sand for gas, 8,159-75 ft. in the F-15 sand for gas, 8,270-75 ft. in the Blessing sand for gas, 8,416-22 and 8,429-32 ft. in the Braden sand for gas, 8,480-82 ft. in the F-18 sand for oil, and 8,549-53 ft. in the F-19 sand for gas.

Total daily potential of the two oil zones is 316 bbl. And first tests of the gas zones indicate, Texaco says, a total gas potential of about 7,500 M.c.f.d.

Site of the 1 McIntosh is within the city limits of Blessing, Tex. The well was drilled by Bay City Drilling Co., Bay City, Tex. Drilling and completion operations to date have been supervised by A. B. Lewis and R. L. Robinson, Texaco drilling foremen.



Sextuple sidelined . . . Current titleholders as the world's most multiple wells are three sextuple completions—all in Texas.

Sunray Mid-Continent Oil Co. operates two of them—one producing gas from six pays in North La-Ward field in Jackson County, the other five zones and one oil pay in McFaddin field of Victoria County.

Humble Oil & Refining Co. operates a sextuple oil well among its many multiples in Borregos field in Kleberg County.

Sunray Mid-Continent earlier this year laid plans for an octuple completion to produce eight gas zones in its McFaddin E-21 well. But this one flopped when the company, instead of eight gas sands, found only three productive gas sands along with two oil sands (OGJ, February 20, p. 83).

Water Flood Planned in North Dakota

RIVAL field in Burke County, North Dakota, has been unitized, and secondary-recovery operations will start soon.

The state Industrial Commission last month approved unitization and a water-flood program for Rival.

A Dakota-formation water supply has been developed for use in the operation.

Preliminary estimates show the project will increase oil recovery by 4 million barrels.

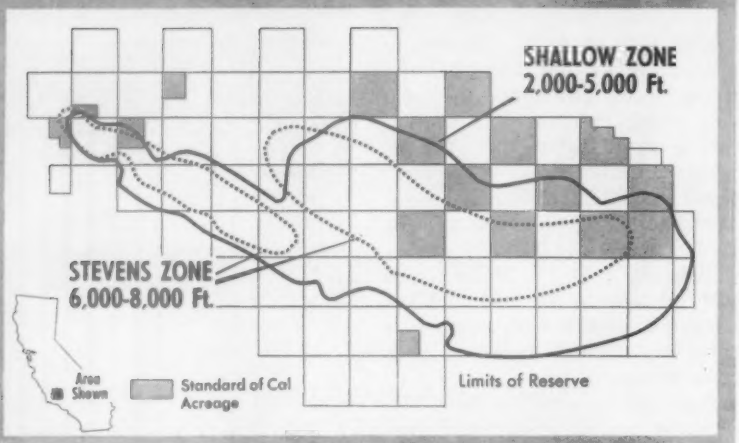
Pan American Petroleum Corp. is operator for 33 working-interest owners. Joining the unit were 240 royalty owners. Unitization was completed this month.

Oil Chem Corp., Dallas, will build and operate a natural-gas processing plant and a gas-gathering system in the field. Construction will start this month.

The plant will process gas from Rival, Portal, Lignite, Flaxton, Woburn, Rennie Lake, Northeast Foothills, Foothills, and Black Slough fields.

What's in Naval Petroleum Reserve No. 1 (Elk Hills Field)

RESERVES (Million bbl. 6-1-61)	
Shallow	342.7
Stevens	683.4
Total	**1,026.1**
PRODUCTIVE CAPACITY (B/D)	
Shallow	75,000
Stevens	100,000
Total	**175,000**
CURRENT PRODUCTION (B/D)	
Shallow	12,000 (726 wells)
Stevens	none (225 wells)
Total	**12,000 (951 wells)**
ACREAGE	
Navy	37,554
Standard of Cal	8,541
Total	**46,095**



Elk Hills Operation Up for "Fee-Basis" Bids

- Standard of California won't keep running field without fee. This opens door for another company to be operator and buy Navy's share of production.

THE NAVY will accept fee-basis bids until August 16 from companies that want to serve as operator of Naval Petroleum Reserve No. 1, the California property which includes Elk Hills field, the state's largest known oil reserve.

Standard Oil Co. of California operates the reserve without fee, but is ending its agreement at the close of the year.

The company announced it would no longer operate the reserve on a no-fee basis after the Navy turned down its proposal to swap 112 million barrels of reserves in the deep (Stevens) zone for 84 million barrels of reserves in the shallow zone (OGJ, June 26, p. 126).

If another company took over the operation it apparently would be able to buy the 90% of the field's 12,000-bbl.-daily production which now is sold to Standard of Cal. But no acreage would change hands. The reserve covers 46,095 acres, with Socal holding 8,541 acres and the Navy the remainder.

The field's production potential is 175,000 bbl. daily and recoverable reserves are placed at 1,126.1 million barrels. The latter figure does not include 17 million barrels of estimated reserves in the Carneros zone, a 9,000-ft. pay section in which only three wells have been drilled. The Carneros is held 100% by the Navy, but is shut in.

All production in Elk Hills comes from the shallow zone, which includes 726 producing wells. The only production from the Stevens is for testing and maintenance. There are 225 shut-in producers in the Stevens. The shallow zone produces 20°-gravity crude and the Stevens 35° crude.

Who will bid? . . . Just who will take a crack at trying to operate the reserve for the Navy has not been revealed.

It's logical to assume Standard of Cal will make a bid.

Any company that comes up with an agreement will be working in a unit which gives the Navy power to control the exploration, development, and rate of production in the field. A law passed in 1944 gave Navy this control.

The reserve was created in 1912 when a presidential order set aside the Kern County area for exclusive Navy use or benefit. First oil was discovered in 1919. The reserve has produced 101 million barrels of oil since the field was unitized in 1944. All but 4 million barrels has come from the shallow zone.

Standard of Cal estimates 40% of the reserves have been depleted in the shallow zone while only 1% of the deeper Stevens zone oil has been produced. But even with the field in this state of depletion, reserves are still slightly over 1 billion barrels.

INDUSTRY

Purchase of 215,949 shares of Great Northern Gas Utilities, Ltd., common stock for $9 a share was announced by Camerina Petroleum Corp. These shares, together with 102,578 acquired earlier, give Camerina about 45% of Great Northern's outstanding common shares.

LPG production is planned by Suburban Propane Gas Corp., Whippany, N. J. The company bought Frio-Tex Oil & Gas Co., Corpus Christi, Tex., which has 42 gas wells, a 30-mile pipeline, and leases in Frio County, Texas. Suburban plans to build a 20,000-M.c.f.d. plant for production of propane, butane, and natural gasoline.

An Oregon tidelands exploration permit has been awarded to Union

Sixteen Firms Have Smog-Control Devices

- Oxy-Catalyst auto afterburner is first device accepted for testing, but California board studies others.

A FIELD of 16 companies is expected to provide the auto exhaust afterburners which California will adopt to control smog.

Based on the latest information from the Motor Vehicle Pollution Control Board, one afterburner has been accepted for testing, eight applications have been filed, and seven other applications are expected.

A few more firms may get into the act, but at present these 16 make up the field of contenders.

Socony Mobil Oil Co., may become the first oil company to submit an afterburner. Several companies familiar to oil have submitted or plan to submit a control device, but no other operating companies have indicated they will file.

Mobil says it has been working on a device for about 3 years. The company has no immediate plans to present the device to the California board.

The one device accepted for testing is a catalytic afterburner developed by Oxy-Catalyst, Inc., an affiliate of Houdry Corp. The Oxy-Catalyst burner was accepted late last month.

Once the state approves at least two afterburners, they will be made mandatory on all California-registered cars. State law requires one be installed on all new and used cars sold in the state beginning the January 1 following adoption of at least two types. Within 3 years, all cars in the state must have an approved exhaust-control device.

Costs . . . One of the big questions about the afterburners is: What will they cost the motorist?

Competition, rather than the state of California, is expected to answer this question, according to Donald A. Jensen, MVPCB director.

Jensen says the state has the right to set a price tag on the afterburners, but probably will merely serve as a watchdog to see that prices are not too high.

None of the applicants has set a price tag on their test device, Jensen added.

It is expected to take about 6 months to test the devices. If they meet the requirements, they will be certified for sale to the motorist.

Oxy-Catalyst will provide the state with five prototypes of its burner for the first tests. Jensen says the state wants to check out the bypass feature of the device before getting another 20 prototypes for the remainder of the tests. All devices will be road-tested for 20,000 miles before being approved.

Who's in race . . . The Oxy-Catalyst burner is one of seven catalytic burners for which an application has been filed.

Other companies with catalytic afterburners are Arvin Industries, Inc., Chromalloy Corp., W. R. Grace & Co., Standard Products Co., Universal Oil Products Co., and Wolverine Tube Division of Calumet & Hecla, Inc. Two companies, the Morris-Williams organization of Los Angeles and McAlester Aircraft, Inc., have filed applications for direct-flame afterburners. These will be screened to determine if they should be tested.

Other than Mobil, those companies expected to file applications are American Cyanamid Co., Du Pont, Ethyl Corp., Holly Carburetor, Minnesota Mining & Manufacturing Co., and Union Carbide Development Co.

BRIEFS . . .

Oil, which will do seismic work in the recently opened territory. Shell and Gulf earlier were given exploration permits.

A digital computer has been installed at Gulf Research & Development Co.'s Harmarville, Pa., laboratory. The IBM 7090 will be used to interpret geophysical and geological field data and to solve problems in reservoir engineering, manufacturing, and distribution.

Macdonald Oil Corp., Dallas, has bought 65 Texas oil wells from a Philadelphia investment group headed by Fred Fox. The wells, in Dorward and Justiceburg fields of Garza County, produce a total of 10,000 bbl. a month. Purchase price was not announced.

Study of surface deterioration on asphalt roads is being sponsored by National Bituminous Concrete Association. Purpose is to develop a test that will identify asphalt-aggregate combinations that may ravel. The Texas Transportation Institute, College Station, Tex., has undertaken the project.

Jade Oil Co. has acquired one-half interest in the Salt Lake oil field of western Los Angeles. Financial details of the agreement with Buttram Petroleum Co. were not announced. Jade received half interest in three wells producing from formations between 2,500 and 3,000 ft. Jade will drill another well to 7,000 ft.

Gas-power generation equipment will be manufactured by an Arkla Gas subsidiary. Proposed plant site is Ingersoll Corp.'s land and building in Shreveport, La., for which Arkla Air Conditioning Corp. has agreed to pay $75,000. The operation will expand the utility's emphasis on gas-operated engines for independent production of electric power.

A new Texas law will solve the Railroad Commission's enforcement-fund shortage. Effective August 28, the commission can transfer surpluses from its gas-utilities fund to the oil and gas-enforcement fund. A decline in Texas oil production has whittled the latter far below the needed amount.

California outlets of Humble Oil & Refining will soon total 86. The company is buying 21 service stations in the San Joaquin Valley owned by Petroleum Products Co., Stockton. Humble plans to switch the stations to Enco outlets.

CVP Goes After Second Maracaibo Producer

• Venezuelan national company's second test also adjoins flush production developed by private firms. Continued success will create market problem.

HAVING shot its first fish in a barrel, Venezuela's new national oil company is drawing a bead on a second cinch with plans for another well offsetting prolific production established by private oil companies.

Venezuelan Petroleum Corp. (CVP) tested its first well at the rate of 3,850 bbl. daily of 35°-gravity oil through a ¾-in. choke. The Eocene well was drilled to a total depth of 13,022 ft. at a location only 3,800 ft. from a field being developed by both Shell and Phillips.

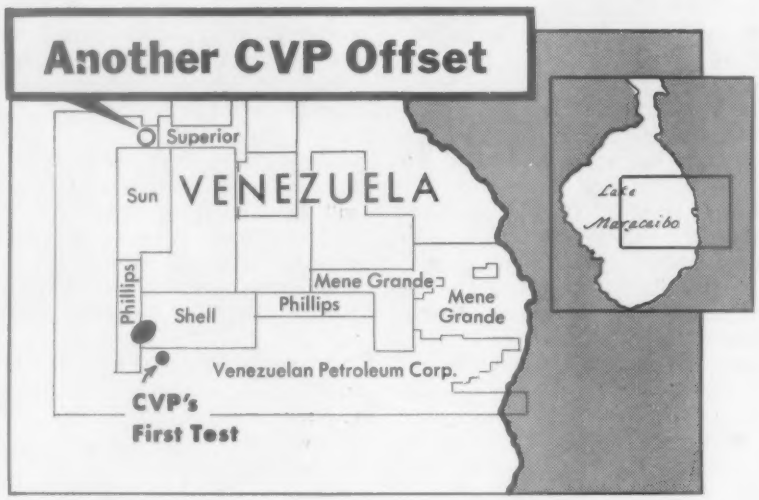
The well, 9L-1, was spudded May 12 by Delta Drilling Co., directly offsetting the field which straddles adjoining Lake Maracaibo concessions held by the two private companies (OGJ, May 15, p. 119). The companies are now producing about 60,000 bbl. daily from the area and are preparing to unitize.

Preliminary testing of the well took place last week after a blessing from the Bishop of Maracaibo in the presence of more than 1,000 onlookers. The successful test paved the way for CVP to try another proved location in the lake—again offsetting established production by three private companies.

The new target is almost 24 miles due north of 9L-1 and is fitted snugly in another corner of CVP acreage next to flush producing wells. These producing areas were established by Superior Oil Co. and a group headed by Sun Oil Co. To the north, Creole Petroleum has several productive wells.

The successful CVP well and the second target area are both on acreage handed to the national company on a silver platter by the Venezuelan Government. And both locations offset productive areas for which private companies paid the government whopping bonuses.

The new prospective location offsets a 7,773-acre block for which Superior paid the government a bonus of $22 million in 1956, a record price of $2,833 an acre.



Superior, which had the first startling drilling success on the newly issued 1956-57 Lake Maracaibo concessions, now has 27 wells on its relatively small block, but the company has always had difficulty finding a market for its production.

U. S. import controls, an extremely tight crude market, plus government pressure against price shaving to find a market, all combined to force Superior to suspend drilling in the block. The company produced about 80,000 bbl. daily during the first quarter of this year with half its wells shut in.

South of the planned CVP location, a group led by Sun Oil has drilled 50 wells on a large north-south field which is obviously a southern extension of the Superior production. The Sun group is producing about 90,000 bbl. daily from this field with at least half its productive wells shut in. Most of the Sun wells are dual Eocene producers making 32°-gravity oil.

Crude market question . . . The Venezuelan Government has yet to give anyone a clear-cut answer on its plans for the oil found in this almost sure-fire drilling pattern in the lake.

At ceremonies for the completion of the first well last week, Dr. Juan Pablo Perez Alfonzo, Minister of Mines and Hydrocarbons, repeated what he has said before—that the oil will be sold in Venezuela's "natural markets." In the past he has said repeatedly that the new national company will not try to compete with existing private oil producers nor will it make any attempt to steal the markets of the private companies.

There has been widespread speculation that disposal of the Venezuelan national company's crude was one prime purpose in Perez Alfonzo's calling the recent conference of Latin American national oil companies in Venezuela. It was suggested that the Venezuelan oil minister wanted to work out deals with the Latin American countries to take the national oil company's production.

The oil official denied last week that there has been any change in Venezuela's past policy against bar-

tering oil for the goods of other Latin American countries. He said Venezuela will cling to its policy of selling oil for cash in hard currencies, but conceded that he wants more trade with the countries who buy Venezuelan oil.

Crude from the tests of the first well was taken by Signal Oil because of the proximity of the Punta Palmas terminal in which Signal has a half interest. Signal says it has no contract for the purchase of future CVP crude and does not anticipate making such a purchase-agreement deal.

CVP and unitization . . . At both locations, the national company is walking straight into a ready-made situation that calls for unitization and will certainly reap all the benefits of a minor partner in any large production unit.

Shell and Phillips have already signed a unit agreement to cover operations in their adjoining Maracaibo producing areas. This unit, which would put a stop to wasteful offset drilling races, has been submitted to the government for approval, but no action has been taken. The first successful CVP well, almost certainly tapping the same Eocene reservoir now being developed by Shell and Phillips, make the national Venezuelan company a natural as a junior partner in the unit once it is approved.

The same would certainly hold true in the case of an almost identical situation confronting Sun and Superior in the area to the north.

ENI Considers New Foray Into European Market

• Trieste-Austria crude line proposed as second Italian bid for rich Swiss, Austrian, and Bavarian markets. Rival project would make competition rough.

ITALY'S Enrico Mattei is winding up for what he hopes will be the second punch of a one-two combination in his fight with private companies for markets in Central Europe.

Construction has already started on the first project in his two-pronged attack. This is a major pipeline system running north from Genoa to Switzerland and Germany.

The second project is a pipeline system from Trieste into Austria. ENI, the Italian state oil agency which Mattei heads, has this proposal under serious consideration.

Purpose of the two pipeline systems would be the same: To win a big chunk of the Swiss, Bavarian, and Austrian markets now supplied by private companies.

However, Mattei faces some tough competition.

For example, preliminary work is under way on a major pipeline into Bavaria that would be a direct rival to Mattei's Italy-Germany project. Nine oil companies are taking part in this competitive venture, a 185-mile 24 to 26-in. line from Karlsruhe to Ingolstadt.

Genoa system . . . The pipeline under construction from Christopher Columbus' home city will have about 325 miles of 22 to 26-in. line and 300 miles of 14 to 18-in. line.

The line will cross the Italian Alps and enter Switzerland through Grand St. Bernard tunnel. The first terminal will be at Aigle, Switzerland, where a 40,000-bbl. refinery is under construction. ENI has one-third interest (OGJ, June 19, p. 82).

The line, named the Central European System, will then head northeast and cross the extreme western end of Austria to the east of Lake Constance. The route then turns north to Altheim, Germany, south of Ulm, where it will split. One branch will run northwest to Stuttgart, and the other, northeast to Ingolstadt.

The crude system will have a capacity of 320,000 to 360,000 bbl. daily. Of this amount, 100,000 to 120,000 bbl. daily will be delivered to terminals in Italy, while the remaining 200,000 to 240,000 bbl. daily—some of it possibly Russian crude—will be delivered to terminals north of the Alps.

Germany plans . . . ENI's plans for German marketing still are in the formative stage. The agency has increased its interest in a subsidiary, Suedpetrol AG, from 50 to 74%, and Mattei has become chairman of the board. German banks hold the minority interest.

But Mattei continues to have a financing problem. He needs to raise money for a refinery he expects to put on stream at Ingolstadt in the second half of 1963, when the pipeline will open. He also needs backing for a Stuttgart plant. This project has been moving slowly, and land for a refinery site still must be purchased.

The original plan was to have local banks turn over some of their interest to a German company which would help support the program. So far, however, Mattei has been unable to find a partner. The extent to which local banks will underwrite a major construction program is one of the biggest questions facing the Italian industrialist.

Trieste project . . . Mattei says ENI's discovery of a major oil field in the Persian Gulf off Iran will give the agency enough crude to support a system into Austria.

He denies that ENI plans to later tie the proposed Austrian system into a pipeline from Russia. An Italian pipeline terminating in the Vienna area would be relatively close to the southern branch of the Comecon system, under construction from the Second Baku area into eastern Europe.

If such a tie up were made, the flow of crude could be reversed in the Trieste-Austria section and Russian crude delivered to the Mediterranean seaboard by pipeline.

Rival pipeline . . . The participating companies in the Karlsruhe-Ingolstadt pipeline which will compete with Mattei's Genoa-Switzerland-Germany project have formed Rhein-Donau Oeletung, G.m.b.H. to build the line.

Proposed route runs north of the towns of Pforzheim, Ludwigsburg, Aalen, and Donauwoerth. The first terminal would be in the Ingolstadt area, where both Shell and Esso plan refineries.

The $7.5 million cost of the initial line will be put up by the nine partners "in proportion to the an-

ticipated crude oil requirements of each. Initial throughput capacity will be 160,000 bbl. daily at a total cost of $35 million.

Companies involved in the formation of the new pipeline company are BP Benzin and Petroleum AG, Deutsche Shell AG, Deutsche Erdoel AG, Esso AG, Gelsenberg Benzin AG, Mobil Oil AG, Scholven-Chemie AG, Wintershall AG, and Deutsche Total Treibstoff, G.m.b.H.

Both Shell and Esso have made firm refinery plans. In the case of Esso, the company is winding up negotiations with the Bavarian Government for the purchase of a site for a 40,000-bbl. refinery at Ingolstadt. Projects of other companies still are in the planning stage.

The Karlsruhe-Ingolstadt system will be an extension of a big-inch line from the Marseille area to Karlsruhe.

Meanwhile, deliveries of 34-in. pipe are being made to three staging areas along the South European Pipeline route. Eighty per cent of the pipe—about 140,000 tons—has been ordered for the system from French steel mills by Soc. du Pipeline Sud-European, owned by a group of 19 companies. Spreads will start moving this month on the southern section of the line at Beaurepaire.

A harbor-expansion program also is in progress at Lavara, 25 miles west of Marseille, the Mediterranean terminal of the system.

South European is scheduled to open early in 1963, with an initial capacity of 200,000 bbl. daily. This will be stepped up to as much as 600,000 bbl. daily.

Reds Join Pakistani Oil Hunt

- **Russia to supply $35 million in equipment and services for 5-year program. Potwar region gets first attention.**

PAKISTAN and the Soviet Union last week signed a formal contract which calls for the Russians to supply about $35 million worth of equipment and expert services over the next 5 years to look for oil in Pakistan.

Maj. Gen. M. Hayauddin, director general of the Bureau of Mineral Resources, signed the final contracts on behalf of Pakistan. S.S. Bourdachev, vice president of Techno-Export, represented the Russians.

The first team of soviet technicians is expected to arrive in Pakistan in October to begin a geological survey of the Potwar region where British-owned companies are now producing less than 8,000 bbl. of oil daily—Pakistan's sole oil output.

The Russians will also do geophysical work in the Baluchistan and Sind areas of West Pakistan and in the eastern, northern, and southern regions of East Pakistan. No drilling is expected until at least a year after the geophysical and geological work.

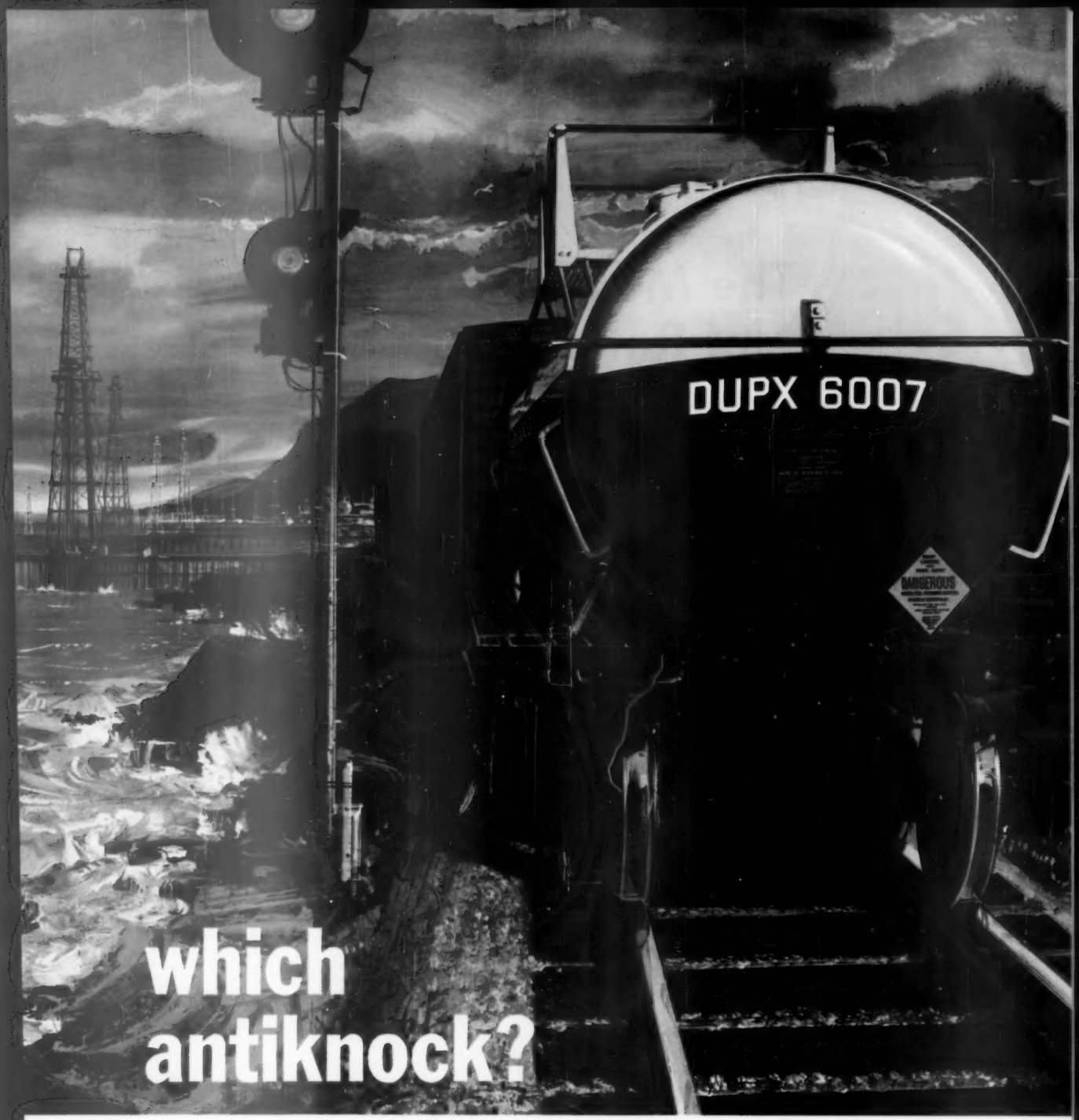
The newly signed contract spells out in detail what is expected of both the Russians and the Pakistanis under a preliminary agreement signed in March. The negotiating team for the Russians arrived in Karachi May 31 and talked until July 3 when the final contract was signed.

The Pakistani-Russian agreement isn't remarkable. It is the latest in a series of similar Russian "aid" projects in the world's undeveloped countries. Motives behind these deals are considered to be purely political (OGJ, June 26, p. 134).

Terms not known . . . Full details of the contract have not been revealed, but the original agreement called for Pakistan to repay the soviet credits for equipment and technical help over a 17-year period at low interest rates. The contract calls for the soviets to train Pakistanis in all phases of oil exploration, but there are no final provisions for personal training outside Pakistan.

The day before the contract was signed, Hayauddin told a meeting of Pakistani businessmen he thinks "sheer bad luck" is all that kept private companies from finding more oil there in the past 10 years.

He pointed out that more than $92 million has been spent in drilling 97 wells in Pakistan. The Pakistan Government footed the bill for about $25 million of that sum as its 25% interest in most exploration ventures of western oil companies.



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MOBIL RESEARCH ANNOUNCES THE DEVELOPMENT OF THE
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The Megatane System of Rating Gasoline

Based on a five-year study of gasoline performance characteristics, the MEGATANE Rating System overcomes the inadequacy of partial ratings (such as octane) and provides an all-inclusive rating of gasoline performance.

As every gasoline technologist knows, octane rating is an important factor in the evaluation of gasoline. He also knows that it is far from the total measure of gasoline quality.

Since the octane rating was introduced 34 years ago, brilliant advances have been made in petroleum technology. For example, the invention of platinum reforming provides a means of producing a higher-energy gasoline that satisfies today's high-powered motors. Metal deactivators were developed to prevent carburetor gum deposits that foul carburetors and stick chokes. Phosphorous additives were developed to neutralize harmful combustion deposits and to give longer spark plug life. Detergent additives were introduced to keep carburetors clean.

These and many other characteristics are important to the gasoline user today. Unquestionably, there is a great need for a broad standard of gasoline performance that recognizes all of these factors. It is this need that Mobil research has sought to answer.

Development of the MEGATANE Rating System

The MEGATANE Rating System evolved from analysis of the many desirable performance qualities of a gasoline. This was coupled with an intensive study of the primary benefits and secondary effects of providing these qualities. This was important because in many cases these secondary factors altered the primary benefits, sometimes with unfavorable side-effects.

After long consideration and discussion, a large group of performance qualities was isolated as representing the important properties of today's ideal gasoline.

Evaluation of all these qualities was a complex undertaking—for the goal was not only to evaluate the qualities of a gasoline, but to be able to predict the gasoline's performance.

The MEGATANE Rating System

Our MEGATANE Rating System accommodates all the important qualities in today's gasolines. The MEGATANE rating of any gasoline is the total number of **effective** qualities it possesses on the MEGATANE scale.

In order to be **effective,** the quality must not only provide the performance advantage for which it is intended, but it must be free of adverse side effects which would cause trouble. This condition indicates the need of quality controls which define the effectiveness of every quality feature on this overall basis.

For example, high volatility is desirable to provide good cold engine response for fast acceleration. However, if the volatility is too high, so that it "vapor locks" the engine, it is no longer effective and no credit for this feature is given in the MEGATANE Rating System.

Another example, an **effective** carburetor deicing additive must not only efficiently combat stalling that occurs under icing conditions, but it must also be free from any adverse characteristics such as emulsification or chemical reaction that could shorten fuel filter life or foul carburetor operation.

In all such cases, the MEGATANE Rating System does not credit the positive advantage unless it is actually provided and unless it is free from any harmful effects such as indicated above. Both of these conditions must be satisfied to consider a quality **effective** in the MEGATANE Rating System.

The Octane Measuring Stick

The widespread use of octane ratings as a measuring stick of gasoline quality has been valuable to the extent that it has rated an extremely important factor in gasoline performance during an era of rapidly increasing engine compression ratios. This trend, however, has now sharply decelerated. Now there is a real need for a broader and more meaningful rating—one that goes far beyond octane rating in scope.

We believe that the MEGATANE Rating System is an important step forward in the attainment of such a goal. It is the first system to take into account all the important performance factors that enter into today's complex modern gasolines.

A gasoline skilfully formulated to meet high MEGATANE standards will provide, in the opinion of Mobil engineers, dependable total performance in today's cars over the widest possible range of driving conditions.

Mobil Oil Company

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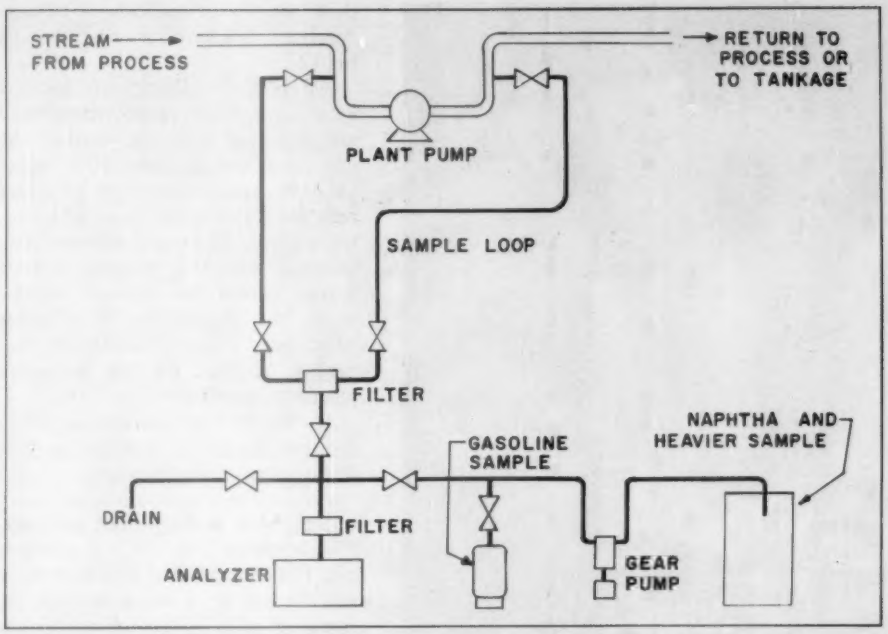


SAMPLE CIRCULATING LOOPS are of ½-in. pipe connected around a plant pump. All analyzers are remotely located. Fig. 1.

How six distillation process analyzers compare with laboratory results

BY CONRAD K. DONNELL
AND MARTIN W. LUTHER
Sun Oil Co.
Newton Square, Pa.

AS PART of an extensive program of automation in the refinery, a combination unit has been equipped with six continuous analyzers to monitor boiling points of five distillate cuts at Sun Oil Co.'s Marcus Hook refinery.

The analyzers record temperatures which correlate with the 50% boiling point of straightrun gasoline, the 90% boiling point of catalytic gasoline, the 95% boiling point of naphtha, the 10% point and end point of furnace oil, and the per cent of the gas oil which boils below 440° F.

Paper presented at API Division of Refining meeting, Houston, 1961.

Four of the analyzers are Sun designs. The other two are commercial instruments.

Performance of the analyzers was evaluated by comparing their corrected readings with laboratory results on the plant streams and on selected standard samples of different boiling ranges. Readings were made over a 2-month period by substituting the standards in place of plant streams normally monitored by the analyzers.

Three analyzers were outstanding, with 90% of the readings deviating from the average reading by 2° F. With one exception, all of the analyzer readings were more consistent than the laboratory distillations of the standard samples.

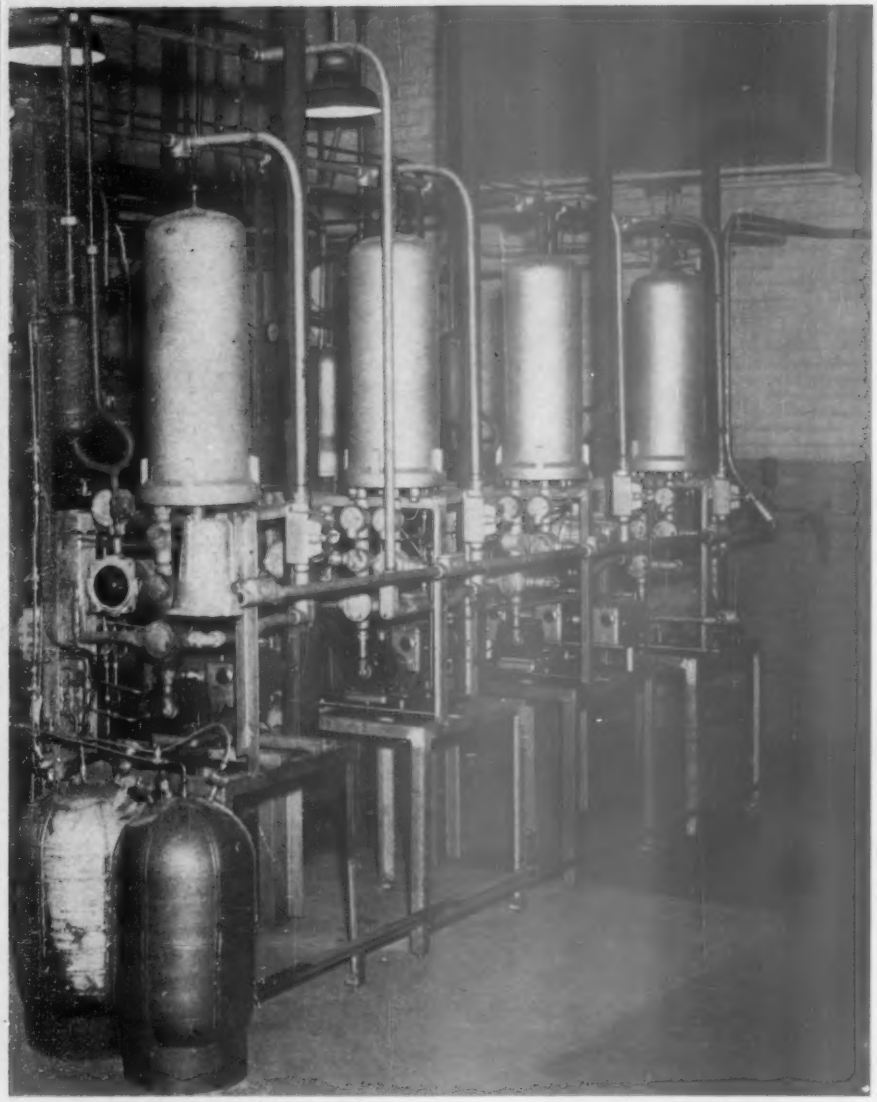
Plant operators accept the continuous instruments and use the results as quickly as they gain confi-

TABLE 1—COMMERCIAL END-POINT ANALYZER AGREEMENT OF CORRECTED ANALYZER READINGS WITH LABORATORY TESTS

Range (°F.)	Per cent of analyzer readings checking within designated range: Routine plant control samples (%)	Samples from analyzer loop (%)	Readings on standard samples (%)
2	23	39	53
4	43	70	67
6	62	93	86
8	74	93	100
10	83	100	...
15	93	...	...
20	100	...	...

TABLE 2—SUN 50% BOILING-POINT ANALYZER AGREEMENT OF CORRECTED ANALYZER READINGS WITH LABORATORY TESTS

Range (°F.)	Per cent of analyzer readings checking within designated range: Routine plant control samples (%)	Samples from analyzer loop (%)	Readings on standard samples (%)
0	2	24	28
1	33	65	63
2	53	83	94
4	73	95	97
6	98	100	100
8	100	...	...



ALL ANALYZERS are located in a compressor room where they are protected from the weather. Fig. 2.

dence in their reliability. The information available immediately on product quality makes possible more uniform operation of the plant unit by permitting prompt corrections to the unit caused by feed changes and unforeseen upsets.

Analyzer Installation

The crude-tower gasoline fraction is taken overhead through a water-cooled condenser to a reflux accumulator where wet gas and water are separated from the gasoline product. Sample for the analyzer is taken at the reflux pump. A similar arrangement is used to sample the synthetic-tower gasoline.

Crude-tower naphtha and gas oil are sidestream fractions stripped with steam in separate towers. Furnace oil is steam-stripped within the crude-oil tower. Analyzer samples from these streams are taken at the pumps which transfer the stripped products to storage.

The sample streams are brought to the analyzer location in loops of ½-in. pipe connected from the discharge to the suction side of the respective pumps. All of the analyzers are located remotely from the process pumps following the general arrangement of Fig. 1. Rapid circulation in the sample loops minimizes the time lag between analyzer and process. The analyzers are connected to the loops by relatively short lengths of small-bore tubing. Analyzer location is shown in Fig. 2.

All of the analyzers are located in a compressor room where they are protected from the weather. At one time, the gasoline 50% point analyzer was installed out of doors near the reflux pump to avoid bringing the volatile sample indoors. Experience with this analyzer over a 1-year period has proved conclusively the desirability of weather protection. Future installations will include shelters for the analyzers wherever possible.

Shown in Fig. 1 is the provision for introducing a standard sample for a check determination.

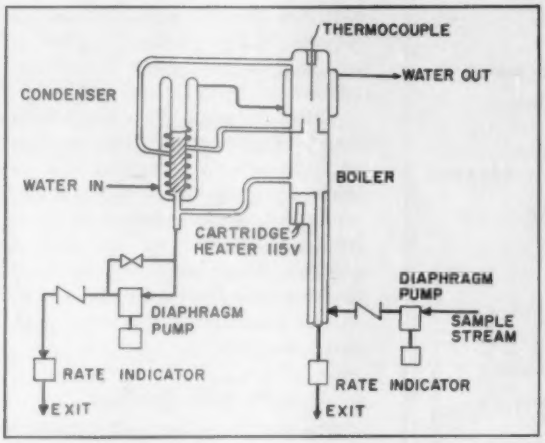
Sun 50% boiling-point analyzer. The analyzer (Fig. 3) is a continuous flash evaporator to which sample is fed at a constant rate by means of a positive-displacement pump and boiled at constant heat input. Distillate is removed from the condensate from a water-cooled condenser at a constant rate equal to 50% of the feed rate by a second positive-displacement pump.

Excess condensate is returned to the boiler as reflux. The remaining 50% of the feed is removed as bottoms from an overflow line in the boiler. Temperature of the vapor from the boiler can be correlated with the ASTM 50% point.

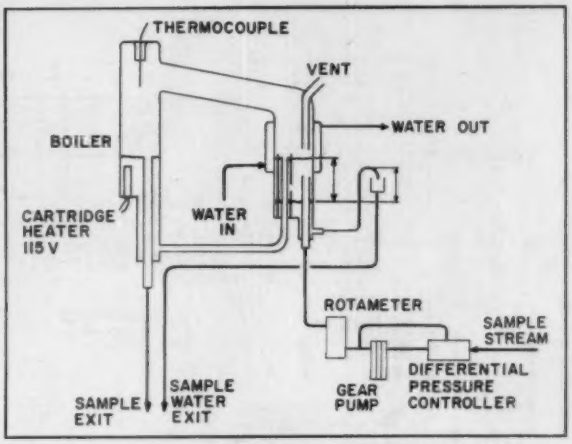
Sun 10% boiling-point analyzer. Charge to this analyzer (Fig. 4) is pumped by a gear pump under constant differential pressure and enters a disengaging chamber designed to separate and dispose of water in the sample. From the water-separation stage, the sample flows to a boiler equipped with a cartridge heater and an overflow line. Vapor from the boiler is condensed and returned to the boiler by way of the disengaging chamber.

All of the sample leaves the boiler through the overflow line. With proper design and positioning of the thermocouple, the analyzer can record the 10% boiling point of the sample.

Sun 90% boiling-point analyzer. The 90% boiling-point analyzer (Fig. 5) is essentially a two-stage flash evaporator. The first stage is similar to the 50% boiling-point analyzer described previously and is



SUN 50% BOILING-POINT ANALYZERS have a continuous flash evaporator to which sample is fed at constant rate. Fig. 3.



SUN 10% BOILING-POINT ANALYZER uses cartridge heater and overflow line. Vapor is condensed and returned to the boiler. Fig. 4.

TABLE 3—LABORATORY DISTILLATIONS OF STANDARD SAMPLES

ASTM D-86, Evaporated Basis

	Degrees Fahrenheit						No. of determinations
	I.b.p.	10%	50%	90%	95%	E.p.	
Crude-tower gasoline	68	123	217	291	...	348	9
Crude-tower naphtha	283	311	334	361	370	387	9
Crude-tower naphtha	297	316	337	369	382	406	8
Crude-tower furnace oil	366	401	425	448	459	480	12
Catalytic gasoline	68	117	235	363	...	408	7
Udex raffinate	155	166	178	208	223	268	8
Reformer charge	284	298	316	353	367	399	8
Heavy naphtha	346	390	415	440	448	460	6
Light furnace oil	267	322	381	448	469	493	8
Reformer gasoline	129	219	301	357	384	435	8

ASTM D-285, Modified Procedure

	I.b.p., °F.	% Distillate below 410° F.	% Distillate below 440° F.	No. of determinations
Crude-tower gas oil	343	1.9	5.0	10

designed to condense low-boiling material with tap water. Effluent from the first stage flows by gravity to the second stage from which distillate is removed by a third positive-displacement pump.

The distillate pumps are adjusted at a fixed ratio to permit 10% of the feed to overflow from the second stage. Temperature of the vapor from the second-stage boiler can be correlated with the ASTM 90% point. Use of a single-stage flash for correlation with 90% point is not recommended because the analyzer temperature is relatively unaffected by substantial differences in the ASTM 90% point.

Sun Hempel analyzer. This instrument (Fig. 6) is a falling-film flash evaporator. Sample is introduced at a constant rate by a gear pump under constant differential pressure. The feed enters the top of a vertical heated rod maintained at constant temperature. Light ends in the feed evaporate and condense on a watr-jacketed condenser which surrounds the evaporator. The distillate flows through a drop counter which records the flow rate as per cent distilled. The result is correlated with the per cent boiling below 440° F. as determined by ASTM distillation D-285 (Hempel distillation).

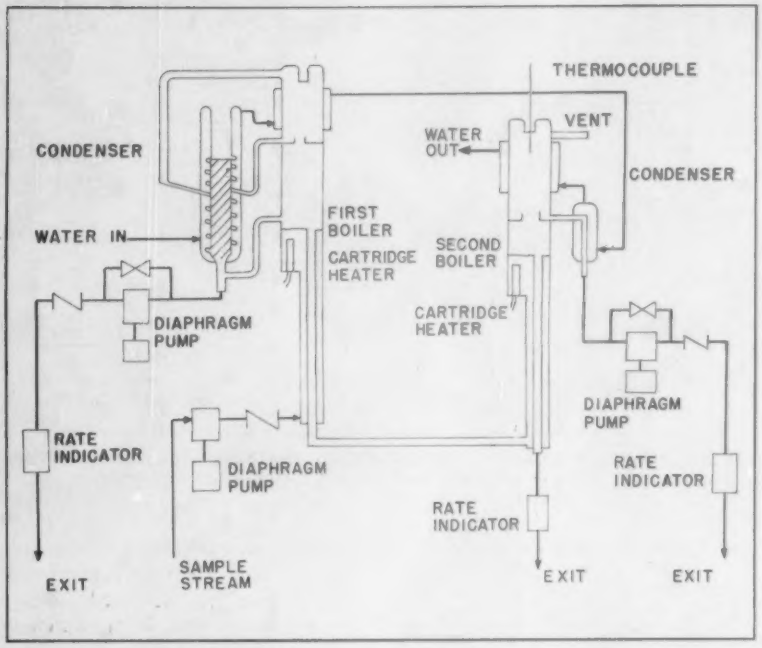
Comparing With Laboratory

During normal operation of the plant-distillation units, samples of each of the product streams are taken every 8 hours by the plant operators and sent to the refinery laboratory for test distillations by ASTM procedures D-86 and D-285. Performance of four of the analyzers was evaluated by comparing the analyzer records with the results from the laboratory over a 6-month period, from March to August 1960.

The comparison was made by calculating the difference between the analyzer reading and the laboratory result for each sample and averaging these differences to determine an average offset for a particular period of time: usually 2 weeks to 1 month. The offset was added to the analyzer reading on each sample to give a corrected analyzer reading. Differences between the corrected analyzer readings and the laboratory results are deviations used as a basis for evaluation.

A large amount of data on deviations calculated in this way was obtained, but the value of this information is questionable because of the uncertainty of sample identity and the error inherent in a single laboratory distillation.

Samples from the analyzer loop. The question of sample identity can be eliminated by drawing the sample from the analyzer loop and marking the analyzer record simultaneously. Laboratory error can be detected by making check distillations. Deviations determined in this manner were calculated from a limited amount of data. The first and second columns of Table 1 and Table 2 compare evaluations made by the foregoing procedures from data on a commercial end-point analyzer and the Sun 50% point analyzer. This information shows agreement with the laboratory is considerably



SUN 90% BOILING-POINT ANALYZER is essentially a 2-stage flash evaporator. Fig. 5.

TABLE 4 — SUN 50% BOILING-POINT ANALYZER RESULTS WITH STANDARD SAMPLES, FEBRUARY-MARCH 1961

Standard—	No. of readings	Avg. offset (°F.)	No. of readings checking within: 0° F.	1° F.	2° F.	4° F.	6° F.	8° F.
Crude-tower gasoline, 217° F. at 50%	14	+26	6	2	4	1	0	1
Udex raffinate, 178° F. at 50%	8	+3	1	4	3	0	0	0
Reformer gasoline, 301° F. at 50%	7	+20	1	4	2	0	0	0
Total	29		8	10	9	1	0	1
Per cent of total			28	35	31	3	0	3
Cumulative per cent			28	63	94	97	97	100

better when samples are drawn from the loop and check distillations are made.

This method of evaluating analyzer performance is not without question as to the validity of the results. There is no positive assurance that the average offset is the proper correction to apply to individual readings irrespective of the value of the reading. It appears likely that the offset will vary with the ASTM distillation range of the product and the slope of the distillation curve.

Unless the variations in the product stream to be analyzed are small, application of a constant offset may give a poor correlation with laboratory results.

Readings on standard samples. Another method of evaluating the performance of distillation analyzers is applied by switching the feed to the analyzer from the product stream normally run to a standard sample. If the variables affecting the analyzer reading have not changed, the anaylzer should give the same reading whenever it is switched to the standard sample. Results of this method applied to two analyzers are given in the third column of Table 1 and Table 2.

Offset between the average laboratory distillations of the standard and the analyzer reading will remain constant unless the standard undergoes changes during its life by loss of light ends or by chemical changes which alter the nature of the material. Deviations determined in this manner are the least of the three methods.

Periodic Readings

During February and March of 1961 each of the six boiling-point analyzers operated continuously on a stream from the unit. At intervals of 1 to 5 days, the analyzer was switched to a standard sample. After a sufficient time for stability, a reading was recorded and compared with laboratory results. Laboratory distillations of the standards are reported in Table 3 as averages of the number of determinations given in the last column of the table.

The 50% boiling-point analyzer normally operates on the crude-tower gasoline stream. It was run on three different standards for checking during the test period with a total of 29 readings made. The first standard was crude-tower gasoline itself. Two additional standards differed considerably from the normal stream with respect to boiling range and slope.

These differences are reflected in the offsets given in the second column of Table 4. Despite wide variation in standards, 94% of the corrected analyzer readings were within 2° F. of the laboratory 50% point.

The 90% boiling-point analyzer operates on the synthetic-tower gasoline stream. It was checked with a similar standard and additional

TABLE 5—SUN 90% BOILING-POINT ANALYZER RESULTS WITH STANDARD SAMPLES, FEBRUARY-MARCH 1961

Standard—	No. of readings	Avg. offset (°F.)	No. of readings checking within: 2° F.	4° F.	6° F.	8° F.	10° F.
Crude-tower gasoline, 291° F. at 90%	7	+29	4	0	0	1	2
Reformer gasoline, 357° F. at 90%	7	+26	1	1	5	0	0
Catalytic gasoline, 363° F. at 90%	11	+34	1	1	5	2	2
Total	25		6	2	10	3	4
Per cent of total			24	8	40	12	16
Cumulative per cent			24	32	72	84	100

standards of crude-tower gasoline and reformer gasoline for a total of 25 checks. About three-quarters of the corrected readings were within 6° F. of the laboratory 90% point and all were within 10° F., Table 5. This analyzer is relatively new, and experience with its operation is necessarily limited.

Both the 50% point and the 90% point analyzer are dependent on the maintenance of constant pumping rates. Rates on the 90% point analyzer were observed to vary and it is suspected that the raw synthetic gasoline may be responsible for fouling the stainless-steel checks in the pumps.

The 10% boiling-point analyzer normally works on the crude-tower furnace-oil stream which is normally fed to the 10% boiling point analyzer. During the test period, three standards were checked: a similar furnace oil, another furnace oil with a light front, and crude-tower naphtha. Results from 29 checks show all of the corrected readings agree with the laboratory average 10% points within 2° F., as shown in Table 6.

One of the commercial end-point analyzers operates on the crude-tower naphtha stream normally and was checked with five standards, two of which were of different boiling range than the normal feed. The analyzer was adjusted to agree with the 95% point of a crude-tower naphtha. Thereafter, no adjustments were made throughout the test period. All of the corrected analyzer readings agreed within 2° F. of the laboratory average 95% point, Tables 7 and 8.

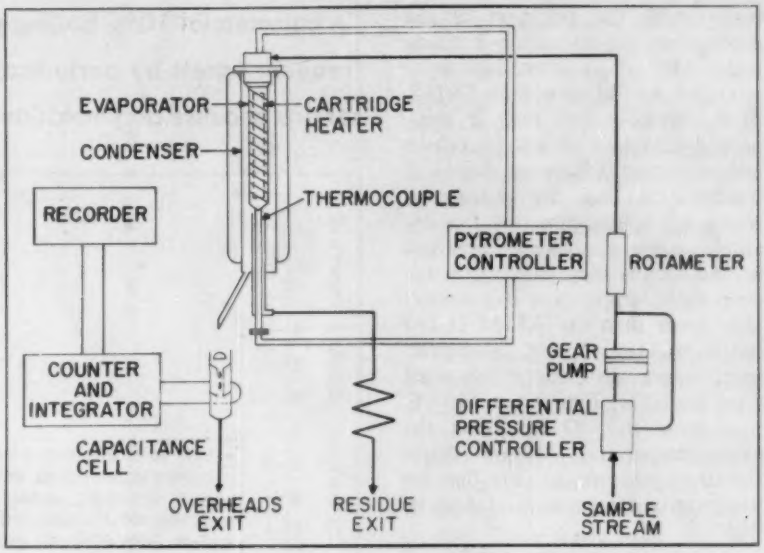
The second commercial end-point analyzer is normally fed with the crude-tower furnace-oil stream. During the test period four standards were checked: crude-tower furnace oil, a furnace oil with a light front, crude-tower naphtha, and a high end-point heavy naphtha. Results show about two-thirds of the corrected analyzer readings agree within 4° F. of the laboratory average end points, and all readings agreed within 8° F.

On furnace-oil service, this analyzer required cleaning every 3 weeks. The thermocouple location is critical and when it is replaced it must be positioned carefully to obtain consistent results.

Fig. 7 shows a comparison of the results from the temperature-recording analyzers. The first three captioned on the figure demonstrate repeatibility within ±2° F. and are judged satisfactory for use on the refinery streams normally analyzed. The two remaining analyzers are not as satisfactory, but the difference is not necessarily definitive of performance on all streams.

The commercial end-point analyzer ran a furnace-oil stream during the test period except for brief intervals on the test sample of naphtha. In view of the effect of coke deposition in the flask and on the thermocouple, it is probable that performance would be better on straightrun naphtha or gasoline. The Sun 90% point analyzer ran untreated catalytic gasoline which, as mentioned before, gave rate trouble by depositing a fouling material on the pump valves. It is probable that performance would have been better had the analyzer operated on a stream of straight-run material.

The Sun Hempel analyzer nor-



SUN HEMPEL ANALYZER is a falling-film flash evaporator. Fig. 6.

TABLE 6—SUN 10% BOILING-POINT ANALYZER RESULTS WITH STANDARD SAMPLES, FEBRUARY-MARCH 1961

Standard—	No. of readings	Avg. offset (°F.)	No. of readings checking within: 0° F.	1° F.	2° F.
Crude-tower furnace oil, 401° F. at 10%	15	+2	8	5	2
Light furnace oil, 322° F. at 10%	8	+3	1	6	1
Crude-tower naphtha, 311° F. at 10%	6	−2	5	1	0
Total	29	...	14	12	3
Per cent of total	..	...	48	42	10
Cumulative per cent	..	...	48	90	100

TABLE 7—COMMERCIAL END-POINT ANALYZER READING 95% POINT RESULTS WITH STANDARD SAMPLES, FEBRUARY-MARCH 1961

Standard—	No. of readings	Avg. offset (°F.)	No. of readings checking within: 0° F.	1° F.	2° F.
Crude-tower, naphtha, 382° F. at 95%	7	+2	5	0	2
Crude-tower naphtha, 370° F. at 95%	6	−3	0	5	1
Reformer charge, 367° F. at 95%	6	+6	5	1	0
Heavy naphtha, 448° F. at 95%	6	−10	1	5	0
Crude-tower furnace oil, 459° F. at 95%	7	−9	2	4	1
Total	32	...	13	15	4
Per cent of total	..	...	41	47	12
Cumulative per cent	..	...	41	88	100

mally reads the per cent of the crude-tower gas-oil stream distilling under 440° F. as determined by a modified ASTM procedure D-285. The laboratory test uses a long-necked flask packed with jackchain and exhibiting a different degree of fractionation than the instrument, which is a falling-film still. For example, some distillate is obtained in the falling-film still when the evaporator temperature is considerably lower than the ASTM D-285 initial boiling point. Moreover, much more distillate is obtained from the falling-film still at 440° F. than from th ASTM still at the same temperature. It was determined experimentally that the evaporative temperature should be 405° F.

Results for a large number of stream samples are shown in Fig. 8. The continuous analyzer records about 1% distilled when the laboratory shows an initial boiling point of 440° F.

Scattering of data in this figure is affected by factors related to sample identity, laboratory error on a single determination, and spurious analyzer readings as a result of water in the plant stream.

A standard sample of gas oil was run through the analyzer producing the data given in Table 9. Results from 12 checks show 92% of the corrected analyzer readings agree with the laboratory average Hempel distillations within 0.5% distilled.

Comparisons With Lab Tests

Nearly 100 distillations of the standard samples were made in the laboratory to arrive at the average test results reported in Table 3. If those test data are separated into groups according to the standard samples run on each analyzer, and deviations from the laboratory average calculated, a comparison can be made with the deviations of the analyzer readings. Such a comparison is summarized in Table 10 which gives maximum deviations of 90% of the data from the average results.

It is evident that nearly all of the analyzer readings are more consistent than the laboratory tests.

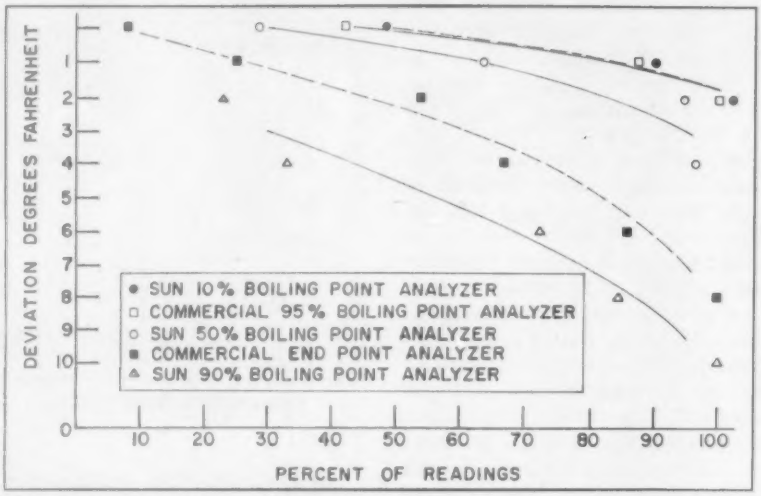
Problems

Sample streams circulating in the loops connecting the analyzers with the process are saturated with water. The cooling which the sample undergoes before it reaches the analyzer causes some of the water to drop out of solution. This free water can be removed from the small stream going to the analyzer by means of a small separator. Suspended water can be removed from certain streams by coalescing in a porous solid. Nevertheless, enough water remains to cause trouble with analyzers which monitor the front end of the sample.

A commercial 10% boiling point analyzer was taken out of service because accumulation of water in its condenser caused frequent upsets by periodically flashing the boiler. This difficulty was overcome by the Sun-designed instrument which can

"A commercial 10% boiling-point analyzer was taken out of frequent upsets by periodically flashing the boiler."

service because accumulation of water in its condenser caused



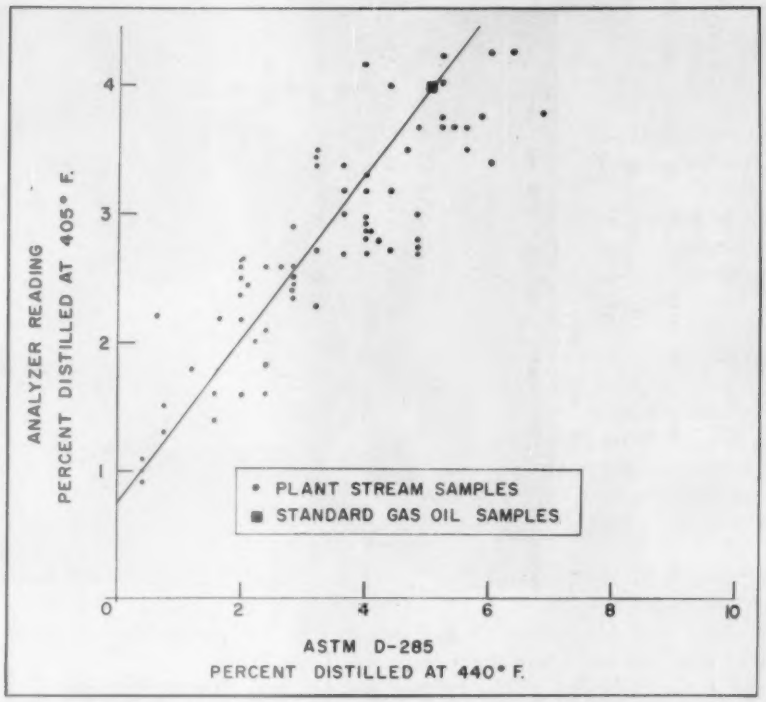
DEVIATION OF BOILING POINT ANALYZERS from laboratory results on standard samples. Fig. 7.

TABLE 8 — COMMERCIAL END-POINT ANALYZER RESULTS WITH STANDARD SAMPLES, FEBRUARY-MARCH 1961

Standard—	No. of readings	Avg. offset (°F.)	No. of readings checking within: 0° F.	1° F.	2° F.	4° F.	6° F.	8° F.
Crude-tower furnace oil, 480° F. e.p.	14	+21	1	2	4	3	2	2
Light furnace oil, 493° F. e.p.	10	+37	2	3	2	1	2	0
Crude-tower naphtha, 387° F. e.p.	6	+4	0	0	0	1	3	2
Heavy naphtha, 460° F. e.p.	6	+4	0	1	4	0	0	1
Total	36	....	3	6	10	5	7	5
Per cent of total	..	....	8	17	28	14	19	14
Cumulative per cent	.	....	8	25	53	67	86	100

TABLE 9—SUN HEMPEL ANALYZER RESULTS WITH STANDARD GAS OIL

Standard—	No. of readings	Avg. offset (vol. %)	No. of readings checking within: 0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
Crude-tower gas oil, 5.0% boiling under 440° F.	12	+1.0	3	3	2	1	2	1
Per cent of total	..	....	25	25	17	8	17	8
Cumulative per cent	.	....	25	50	67	75	92	100



RELATION BETWEEN LABORATORY AND ANALYZER Hempel readings on crude-tower gas-oil stream. Fig. 8.

tolerate considerable water in the feed.

The Hempel analyzer is susceptible to water collecting in the condenser, running through the drop counter, and momentarily recording a rapid distillate rate. This difficulty can be largely overcome by using a stream of air to cool the condenser at a rate sufficient to allow the water to escape as vapor without losing an appreciable amount of the light ends of the gas oil.

Analyzer readings on the standard samples are seldom affected by water because storage of the sample in a drum permits suspended water to settle and cooling results in a lowered content of dissolved water.

TABLE 10 — PERFORMANCE OF ANALYZERS COMPARED WITH LABORATORY RESULTS

(Maximum deviation of 90% of data from average results)

	Analyzer readings	Lab tests on samples
Sun 10% boiling-point analyzer, °F.	1	4
Commercial 95% boiling-point analyzer, °F.	1	3
Sun 50% boiling-point analyzer, °F.	2	3
Commercial e.p. analyzer, °F.	6	8
Sun 90% boiling-point analyzer, °F.	8	4
Sun Hempel analyzer, % distilled	0.5	1.0

Corrosion. Gasolines from sour crude oils contain both water and hydrogen sulfide which necessitate the use of all-stainless-steel construction with welded joints in the analyzers. Other distillates contain sulfur and require similar construction.

Coking. Accumulation of coke in the flask, in the stillhead, and on the thermocouple of the commercial end-point analyzer has been mentioned. In furnace-oil service, the analyzer could be operated for several weeks without cleaning. Two similar analyzers were operated for several months on catalytic gas oil at end points around 650° F. In this service the instruments coked up within 2 days. The analyzers were withdrawn from this application.

Boiler heaters. One problem with the commercial 95% point analyzer has been short heater life. Heaters have lasted only several months in continuous operation. Replacement is not difficult, but the analyzer requires several hours to cool before replacing the heater and several more hours to get back onstream.

Another end-point analyzer has been subject to burned-out heaters. In furnace-oil service, heater life has been long enough to be acceptable, but in the catalytic gas oil service at higher end points, the heaters rarely lasted more than a few weeks.

Thermocouples. The thermocouple supplied as standard equipment with one of the end-point analyzers is extremely fragile. Mechanical breakage and corrosion of the fine thermocouple wires limited the life of the thermocouples to a matter of weeks. They have been replaced with ⅛-in.-diameter armored pencil-type couples which are still in service after more than 6 months of operation, and the end points appear to be as reproducible as those obtained with the original thermocouples.

Cooling water. With the 50% point analyzer installed in an exposed location, cooling-water lines had to be steam-traced to prevent freezing in winter. With warm condenser water, light ends in the sample were lost. Since the liquid distillate rate was maintained constant, the actual total per cent distilled (liquid plus uncondensed vapor) increased, and the point recorded was not the true 50% point. Installation in a sheltered location will overcome this problem, as well as make maintenance easier during inclement weather.

Offset. It is apparent from the tables that offset, or the correction to be applied to the analyzer reading to arrive at the laboratory result, varies considerably with the nature of the sample with respect to boiling range and slope. This variation itself is considered a problem to be overcome in subsequent designs of additional analyzers. If a refinery stream undergoes small variation in boiling range, the offset may be expected to change only an insignificant amount. The user will have to determine for himself the magnitude of offset changes for customary variations in stream boiling range.

Editor's Note:

TWENTY YEARS AGO this month, in July 1941, the first gas was injected into the Tensleep formation of Wertz field, Wyoming.

Two and a half years later, Neil Williams, associate editor of The Oil and Gas Journal, wrote a story on the performance of the project to that time. His article appeared in the December 16, 1943, issue, p. 60, of the Journal under the title: "Pressure Maintenance in Wertz Field Provides Sustained Production."

After 20 years of operation, it seemed to be a good idea to print a followup story on the Wertz unit showing the results of gas and water-injection operations and tracing the pressure-production history and increased recovery due to pressure maintenance.

Which Journal staffer got the assignment to do the story? You guessed it—Neil Williams, of course.

Armed with his pencil, notebook, and faithful fedora, Neil journeyed to Sinclair Oil & Gas Co.'s Bairoil district office and was met there by company production men shown in the photo. From left to right are Don Pickering, petroleum engineer; Editor Neil; Tom DeSalbo, district engineer; Jack Rankin, production superintendent for partnership operations, Tulsa office; and Lloyd Holsapple, chief petroleum engineer, Tulsa office.

The picture was taken in Sinclair's Bairoil district office as the group studied charts, graphs, and reports on Wertz field.

Neil returned to the Journal's Tulsa office with a bookful of notes and some new pictures, and prepared this article on . . .

Wertz field today

—after 20 years of pressure maintenance

PRESSURE-MAINTENANCE operations as carried out by Sinclair Oil & Gas Co. in its Wertz, Wyoming, field are paying off as planned not only in greatly increased oil recovery, but also in getting it in much shorter time than otherwise would be possible.

Involving primarily the field's main Tensleep reservoir, these operations now have been under way 20 years. Started relatively early in the producing life of the reservoir, opened in March 1937, they have been an important factor in the unusually high recovery during this period of 36% of the reservoir's original calculated oil in place. This may be as much as 5 to 6% more than the estimated ultimate recovery might have been by natural depletion.

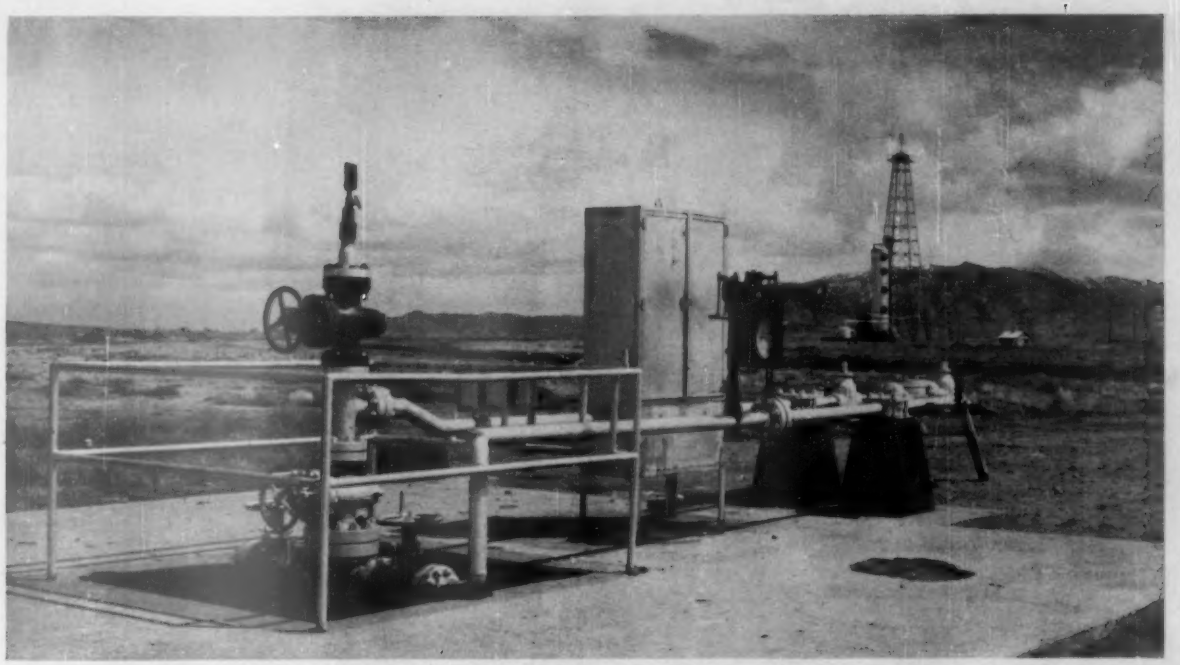
The high recovery factor is particularly significant considering the tightness of the reservoir's producing sandstone. Although ranging up to 20.6%, weighted average porosity is only 10.6%. Permeability varies widely, but averages less than 23.0 md.

Oil production so far has totaled more than 33,372,000 bbl. With original oil in place calculated at 91,500,000 bbl., more than 58,128,000 bbl. still remain in the reservoir. It is estimated that by present procedures at least another 15% of the oil can be recovered with the productive life of the reservoir extended another 10 years or more.

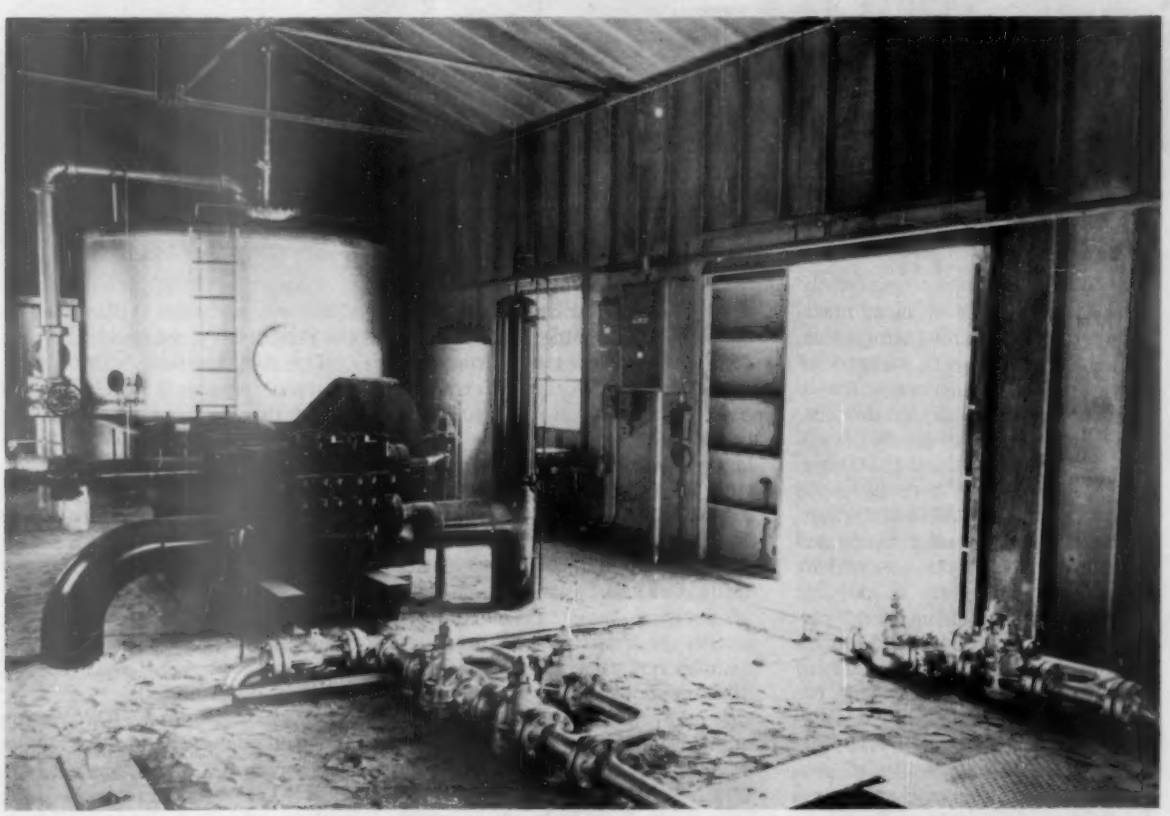
Both gas and water are being injected to augment the natural depletion energy. Gas injection has been under way from the start of the project in July 1941. In this time, more than 22,968,223 M.c.f. of gas has been returned to the reservoir. Water injection, started in October 1954, is in its seventh year with an accumulated input of more than 4,150,000 bbl.

Early planning for production of the reservoir called for adoption of practices that not only would realize maximum ultimate recovery, but at the same time would provide a means of producing the reservoir at higher sustained daily rates of oil withdrawals, variable according to need, than the existing natural-depletion procedure would permit.

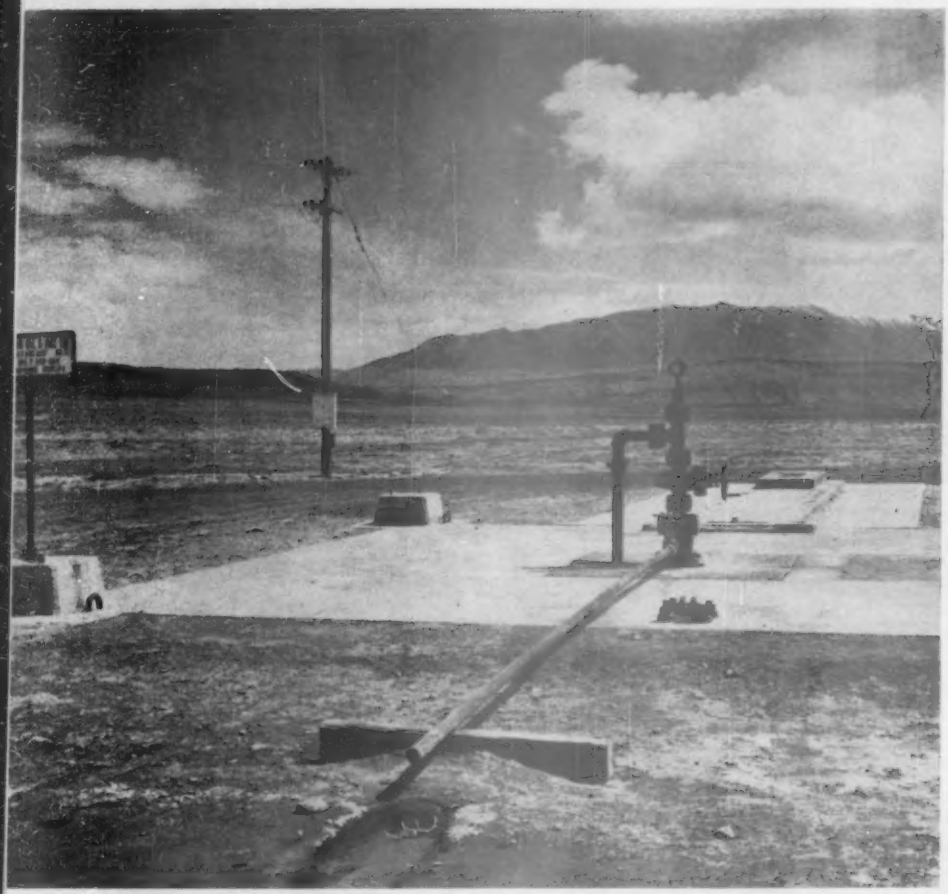
Natural reservoir energy consists of a combination of a fairly active partial hydrostatic drive, and a solution-gas drive actuated by the highly undersaturated oil in the reservoir. Theoretically, effective use and conservation of this twofold natural

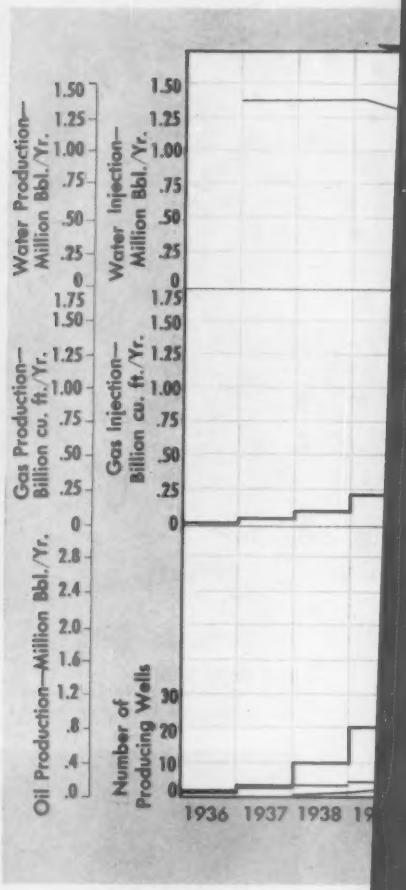


GAS INJECTION at Wertz is through this high structural well (Wertz 19) provided with a packer setting between two main zones of differing permeability. The dual completion permits selective injection to either or both zones for effective use of the gas in the control of its movement to oil wells in the respective zones.



ALL WATER PRODUCED AT WERTZ is brought to this central receiving and pump station for filtering and distribution to the two input wells (Wertz 31 and 32). Wertz 31, located under the floor covering barely visible in the lower left corner, is dually completed for injection both to the main Tensleep formation, and to the deeper Darwin reservoir. Injection into the Tensleep is by gravity flow. Flow to the Darwin in this well and to the second Tensleep input well (No. 32) is by added pump pressure provided by the single triplex pump through a metered manifold. Back of the pump is the sand filter through which the input water first is passed after direct chemical injection for removal of iron oxide.





WATER INJECTION at Wertz is below the water-oil contact through two input wells (Wertz 31 and 32). Shown is Wertz 32, a former Tensleep producing well at the field's most southeasterly location, originally just above the oil-water contact. It takes water at added pump pressure of 85 psi. at the wellhead. Injection through Well 31, off the southwest flank of the field, is by gravity flow.

energy might attain efficient maximum recovery. But it would involve, among other things, control of water movement and restriction of reservoir withdrawals to the rate of water ingress, originally calculated to be from 3,000 to 3,300 bbl. daily.

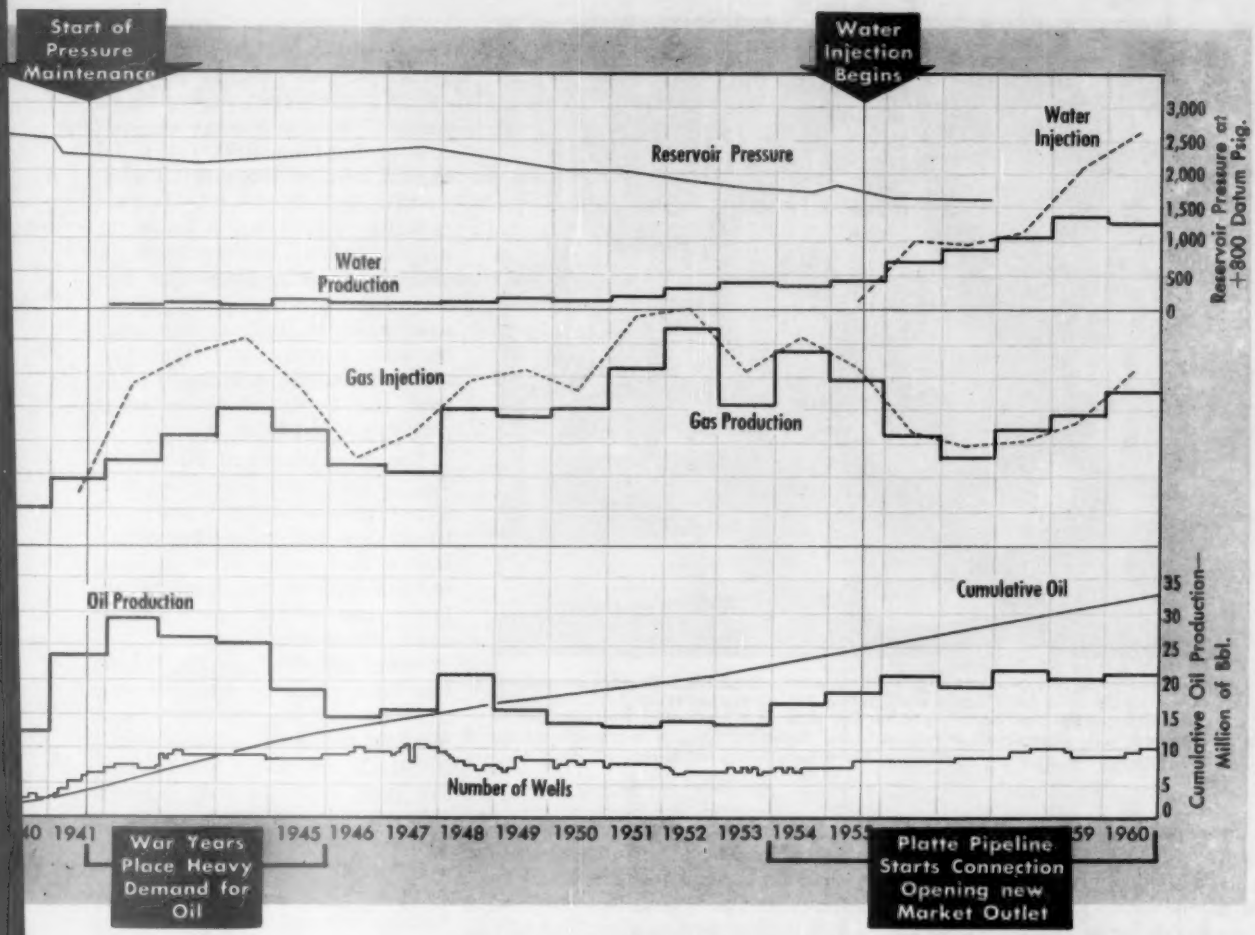
Higher rates of oil withdrawals, dictated both by market needs and economics, were to be attained by maintenance as nearly as possible of a volumetric balance in the reservoir between withdrawals and injections. Theoretically, by replacing in reservoir barrel equivalent the volume of withdrawals in excess of that displaced by the hydrostatic drive, it would be possible to produce the reservoir at any desired rate within reasonable limits simply by increasing or decreasing the volume of gas and water injected.

Oil withdrawals alone during the 20-year period of injection operations have been at daily rates ranging from 1,500 bbl. to as high as 6,500 bbl., sometimes sustained over fairly long periods. Current daily withdrawals are around 4,800 bbl. of oil with 2,000 bbl. of water, and 4,634 M.c.f. (4,710 bbl. reservoir volume equivalent) of gas. Daily injections are running 3,500 bbl. of water and 4,100 M.c.f. (3,750 bbl. reservoir volume equivalent) of gas. Daily oil withdrawals, after 20 years of pressure maintenance, an unusually high recovery factor, and with an optimum number of wells, now are about as high as at any time since the war-emergency period.

Although the desired reservoir balance may not have been realized 100% at all times, reservoir pressure on the whole has been maintained safely above the saturation pressure of 770 psi. Current pressure is estimated to average near 1,500 psi., only 760 psi. below 2,260-psi. average at the start of the project 20 years ago.

This drop has been with oil withdrawals totaling 29,453,000 bbl. during that time, or a drop of only 1 psi. to 38,750 bbl. During the 2-year period before pressure maintenance, reservoir pressure dropped 480 psi. from the original estimated 2,740 psi. with oil withdrawals of 3,919,000 bbl. This was a drop of 1 psi. to 8,165 bbl.

Accumulative oil withdrawals from the reservoir have been with production of 3,742,000 bbl. of water, and 19,051,825 M.c.f. of gas. The gas volume in equivalent reservoir barrels of space occupied is computed to be approximately 19,939,000 bbl. On this basis, all withdrawals have totaled 57,053,000 bbl., or 25.745,000 bbl. more than the volume of water and gas (in reservoir-barrel equivalent) injected.



RELATIVELY HIGH sustained daily rates of oil production, variable according to needs, have been possible from the Tensleep sand at Wertz by maintenance of a reasonably close volumetric balance in the reservoir between withdrawals and injections of water and gas. This is reflected in the statistical record of the reservoir plotted on the chart.

Much of the difference has been taken up by water ingress from the hydrostatic drive which has been calculated at approximately 20,000,000 bbl. Some questions still remain to be answered, as to the behavior of the injected gas in the reservoir and its effect on volume displacement, since the operation is dealing with a gas containing an unusually high percentage of carbon dioxide (49%) and nitrogen (16%). This may affect substantially properties of the fluid in the reservoir.

Operations have been restricted to some extent by a limited volume of gas available for injection. Until recently the primary source has been confined to the solution gas produced with the oil, and what makeup could be obtained from sweet-gas production of the field's early-developed shallow sands.

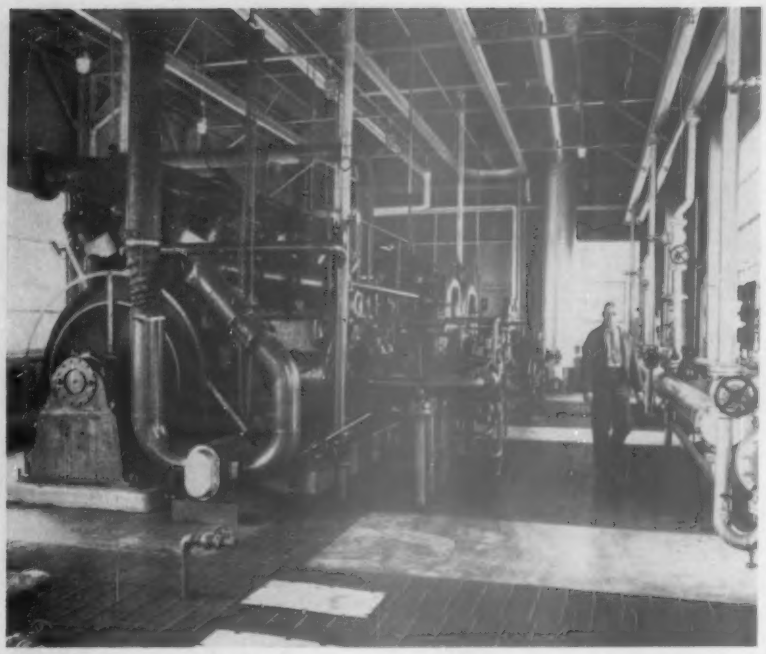
Solution gas at the reservoir's saturation pressure of 770 psi. amounts to 166 cu. ft. per bbl. Early gas-oil ratios ranged from 135 to 270 cu. ft. per bbl. at high producing rates of 300 to 700 bbl. of oil per day. With continued gas injection and spread of the artifically created gas area, there has been an orderly progressive increase in ratios to a present field-wide average of about 900 cu. ft. per bbl. This has augmented the basic solution-gas production with an increasing volume of recycled injection gas.

Some additional gas is obtained from the solution-gas production from two newer and deeper undersaturated reservoirs, the Darwin (lower Amsden) and Madison, both of which were opened in 1948. So far these two horizons have been less extensive than the Tensleep, and the additional gas supply is small.

The Madison, however, is an important contributor of water for Tensleep injection. Although it now has only four producing wells, they make large volumes of water. Water production from these wells has been increased sizably in recent months by replacement of gas-lift by high-fluid-volume pumping. This also has released the gas for Tensleep injection.

Since last August an additional sizable supply of gas for injection has become available with cessation of gas-lift operations in Sinclair's nearby Lost Soldier field. That gas has been diverted to the Wertz operations. For the first few months of its use, the volumes of water and gas injections exceeded reservoir withdrawals for the first time since the earlier years of the injection program.

The Tensleep reservoir extends over an area of 1,030 acres along a northwest-southeast-trending axis of a sharply folded anticlinal struc-



TWO 600-hp. supercharged gas-engine compressors operating in parallel deliver gas to the single dual-zone input well (Wertz 19) at pressures of 1,650 to 1,700 psi. They are capable of handling 6 to 6½ M.M.c.f.d., boosting the pressure in three stages from 40 psi. off the separators. Supercharging is by a belt-driven blower (foreground at base of front compressor) newly installed on each compressor.

ture. Average depth is 5,940 ft. with an average net thickness of 150 ft. in up to possibly six more or less communicable lenticular zones of permeable development. These are grouped for production and injection purposes into two main members.

Thirty-one productive wells have been completed in the reservoirs. Twenty currently are producing from the Tensleep although the number varies as it fits into Sinclair's program of reworking and recompleting wells in one or both of the field's other two deeper horizons as needed to maintain over-all field production at desired levels. Only one nonproductive well has been drilled. It (31 Wertz) was a low well below the oil-water contact and now is one of two water-input wells.

In the beginning there was no free gas in the reservoir. Gas injection was started directly into the undersaturated oil column. So far as is known, this may have been the first time in any repressuring or pressure-maintenance operation in this country that this had ever been attempted. The project itself was proclaimed as the first pressure-maintenance operation in the Rocky Mountain region.

Gas injection began with two input wells, one (19 Wertz), located near the crest of the structure, and the other (20 Wertz) located about 250 ft. downstructure on the southeast flank. Injection through the latter had been intended to saturate the undersaturated oil with gas, improve its viscosity, and thus facilitate movement of the oil to producing wells. This was discontinued after several years because of possible channeling.

Continuation of crestal injection through the No. 19 structurally high well has created an artificial gas-cap area, now spread over an estimated 312 acres. As it expands, it functions to provide an additional medium of energy and depletion by sweeping the area now occupied by the cap, maintaining in part reservoir pressure, and aiding gravity drainage.

The gas-input well has a packer setting separating the reservoir's two primary zones of differing permeability. This permits selective injection to either or both zones for most effective use of the gas in the control of movement to oil wells in the respective zones.

Currently, gas is being delivered to the input well at pressures of 1,650 to 1,700 psi., boosted from 40 psi. at the field in three stages by two 600-hp. supercharged, gas-engine compressors operating in parallel. The compressors are capable of handling 6,000 to 6,500 M.c.f.d. of gas although current injection rate is about 4,100 M.c.f.d.

Water injection is below the water-oil contact to supplement the natural-water drive. Both input wells are on the southeast plunge of the structure in the direction from which the water appears to be coming although its source is believed to be from the Ferris Mountain range northeast of the field.

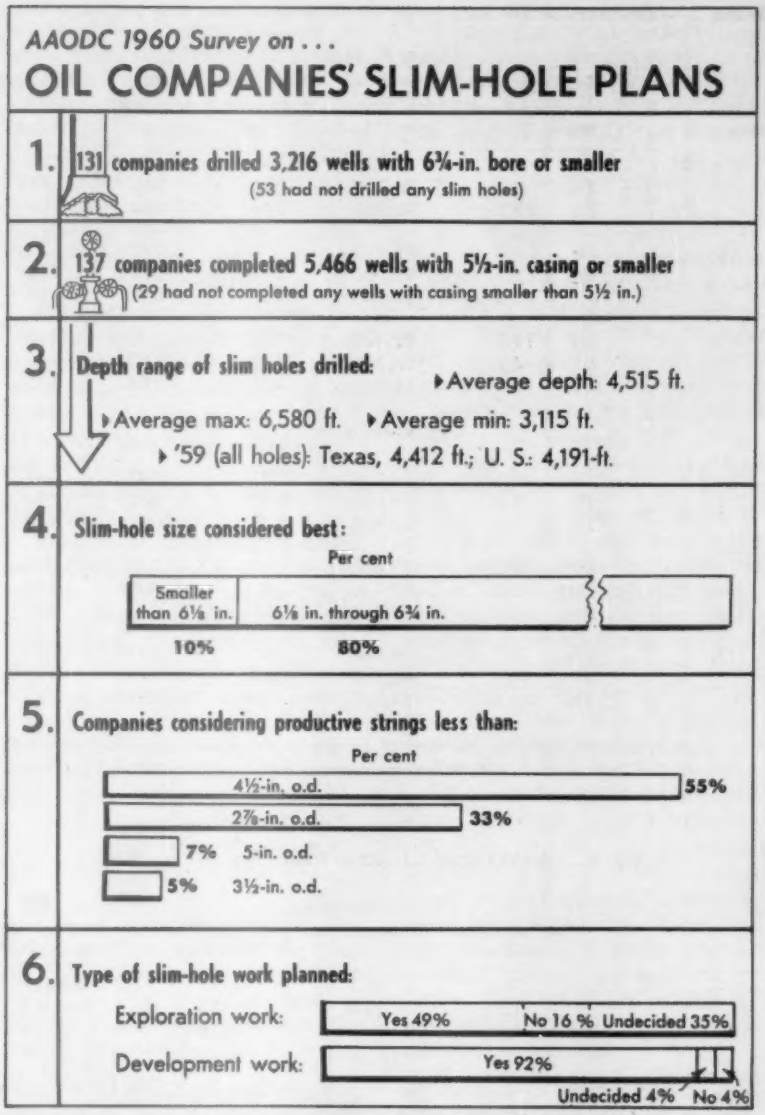
The initial input well (No. 31) off the far southwest side of the field was completed originally as a structurally low well below the contact. It is a dual well with water being injected both to the Tensleep reservoir and to the newer Darwin sand, 500 ft. deeper.

Water injection into the Darwin has been going on since October 1955 through this one well with an accumulated input of more than 1,550,000 bbl. So far, benefits have not been evaluated fully. Current injection rate in this horizon is about 1,590 bbl. daily. The reservoir has six producing wells.

Injection into the Tensleep through this well is by gravity flow from the central water-receiving station, located at this well. That to the Darwin reservoir and to the second Tensleep input well is by added pump pressure. A single triplex pump located at the central water-receiving station serves both.

The second Tensleep water-input well (No. 32) is a former Tensleep oil producer located at the most southeasterly point above the original water-oil contact. Injection through this well, now below the present water-oil contact, was started in May 1959, following that into the initial input well, started in October 1954. Injection pressure at the wellhead currently is 85 psi.

Ability to coordinate all operations of the various productive horizons into a single over-all development and production program to obtain maximum recovery of oil in the shortest possible time has been facilitated by the previous unitization of the field. All of the presently known productive area is embraced on government-owned land operated solely by Sinclair.



HERE ARE RESULTS of a recent survey which indicate that the contractor can expect an increasing demand for slim-hole drilling. Big question: Is he to drill slim holes at a premium price, the same price, or at a reduced price compared to conventional hole sizes. Table 1.

Slim holes can cut hard-rock drilling cost

Field tests made by a drilling contractor show that the slim hole is not just a soft-rock method. It can save money in tougher drilling like West Texas and New Mexico.

BY FRANK M. POOL
President, Pool Well Servicing Co.,
San Angelo, Tex.

MANY drilling contractors have yet to realize that, even though there is romance in big engines and big derricks, there are not proportionate profits.

With a rig properly sized to match horsepower and hydraulic requirements, the contractor can drill slim holes cheaper than conventional-size holes. The saving, contrary to what many believe, does not apply only to drilling soft formations. It also applies in medium-hard to hard formations, including the Permian and Pennsylvanian sections in western Texas and eastern New Mexico.

The important question, of course, is this: "Is there profit for the contractor in slim-hole drilling?" I'd answer that question in the words of the economist who said, in analogy, "There is game in the woods but not everyone is going to get his limit."

Selecting the proper drill string is essential if all possible economy is to be realized from slim-hole drilling. Thin-wall drill pipe or drill tubing is the key to reducing cost in hydraulics. In turn, lightweight drill strings are the key to draw works which are cheaper to buy and operate. One example of the progress toward lightweight drill strings is the new seamless dual-weight drill pipe now being rolled.

How much work is there? In general, the drilling contractor is anxious to drill whatever size wells the producers require. In so doing, however, there are a number of questions he seeks to answer. Some of these are:

What are the prospects from a business standpoint? Can the contractor anticipate a demand for his equipment and services? What profit margin can he expect? Is slim-hole drilling limited to certain types of formations? What is the optimum hole size? How do the risks compare in slim-hole drilling to conventional drilling? What progress is being made in rig design, bits, and metallurgy to provide good tools for slim-hole work? Are slim holes now being used only a crash program to relieve the pinch caused by low allowables? Or, do they have advantages that will make them the accepted rather than the exception?

Answers to some of these questions are reflected in Table 1 which summarizes results of a recent survey by the American Association of

Oilwell Drilling Contractors. The survey was sent to 1,731 operating companies in all areas of the country. There were 185 completed questionnaires returned; most major companies answered as did a substantial number of smaller producers.

This survey indicates that the contractor can expect an increasing demand for slim-hole drilling. Moreover, there is a continued trend to smaller holes to greater depths.

Big question. Now, the paramount question is this: Is the contractor to drill this slim hole at a premium price, at the same price, or at a reduced price compared to conventional hole sizes?

You can't make a silk purse out of a sow's ear. Likewise, you can't economically drill a 7,500-ft. slim hole with the same rig, drill pipe, and drill collars that you would use to drill a conventional hole. If you use drill tubing or equivalent thin-wall drill pipe in drilling slim holes, you also use a lighter string of drill collars. Result is about a 40% reduction in the rig horsepower requirements.

At the same time, hydraulic horsepower needed remains constant or increases only slightly. Table 2 shows this for three common hole sizes.

With the smaller rig, there are immediate savings in fuel, maintenance, insurance, depreciation, moving cost, rigup and rigdown cost, wire line, and other supplies. Labor, taxes, and other fixed costs represent about 40% of rig-operation cost; bits cost about 15%. There remains 45% of total cost over which the savings can apply.

Consider a saving of 25%—conservative on a slim-hole operation. The over-all saving should be approximately 10 to 12%.

A 6¾-in. hole requires 27% less drilling mud than does a 7⅞-in. hole; a 6¼-in. hole requires 37% less. The lower volumes save not only on water and mud materials but also on the size needed for earthen reserve pits and steel pits. Some slim-hole contractors successfully use one steel pit with three partitions.

Bit runs, drilling rates. It is not enough simply to streamline rigs and drill string. Doing so will not by itself reduce costs unless drilling performance in the small-bore hole is comparable to that in the conventional size hole. In comparing results in the small holes, the two key factors are **penetration rate** and **feet drilled per bit.**

In relatively soft unconsolidated formations, slim-hole-drilling rates compare favorably with rates in conventional hole sizes. This has been found to be true in South Louisiana and the Gulf Coast area. Also, footage per bit is good in this area.

One report says that $100,000 was saved on the contract-footage portion of 113 wells drilled in the Denver-Julesburg basin. These wells averaged 5,500 ft. in depth and most of the drilling was with soft-formation bits; only the last bit in each well was a medium-hard type.

The slim-hole drilling in Canada has been more a combination of soft, medium-hard, and hard-formation drilling. In one 20-well program, penetration rates in slim holes were approximately the same as in conventional holes. However, each bit drilled about 35% less footage in the slim holes. This means that bit cost was one-third more per foot in the slim holes. The contractor on this program concluded that other savings offset higher bit cost.

Where roads and locations are a major cost, light rigs and light drill pipe are an important advantage.

What formations are hard. Let us specify which we are calling hard formations and which we call soft; the terms mean different things in different parts of the country. In West Texas and eastern New Mexico, I believe that Permian-age beds can be called soft to medium-soft in the red beds, salt, and anhydrite

TABLE 2—COMPARISON OF SLIM HOLE TO CONVENTIONAL RIG REQUIREMENTS

Hole size, in.:	Drill string: Inches	Drill string: Lb./ft.	Weight of drill string in air (lb.)*	Draw-works engine hp. (input)	Total pressure loss, psi.†	Hyd. hp. at pump sheave
5,000-Ft. Well						
6⅛-6¼	2⅞	6.5	62,800	246	1,026	123
	3½	9.3	76,900	300	801	89
	3½	13.3	96,800	376	880	97
6¾	3½	9.3	79,400	310	947	130
	3½	13.3	99,500	386	1,094	150
	4	14.0	103,000	400	856	110
7⅞	3½	13.3	99,400	385	1,215	251
	4	14.0	107,300	418	857	169
	4½	16.6	116,800	455	786	141
7,500-Ft. Well						
6⅛-6¼	2⅞	6.5	79,300	310	1,241	149
	3½	9.3	99,900	435	872	97
	3½	13.3	132,900	515	961	106
6¾	3½	9.3	113,400	441	1,040	143
	3½	13.3	127,100	496	1,251	172
	4	14.0	139,600	544	936	120
7⅞	3½	13.3	133,900	521	1,497	309
	4	14.0	146,300	570	972	192
	4½	16.6	161,800	630	857	154

*Drill pipe with sufficient number of collars to allow carrying approximately 4,000 lb. per inch of bit. †Assuming an annular velocity maintained at 120 ft./min.; jet velocity of 250 ft./sec.

TABLE 3—COMPARISON OF HOLE SIZES, JAL, N. M., AREA

	No. of wells considered	Average rate of penetration ft./hour	Average feet per bit	Average bit cost per foot
6¼-in.	9	29.7	245	$0.617
6¾-in.	12	28.4	344	0.475
7⅞-in.	12	24.9	370	0.513

sections; these Permian beds are medium-hard to hard in the dense dolomites and sands.

The Pennsylvanian-age beds should be classed as medium-hard to hard and the pre-Pennsylvanian beds as hard to very-hard.

Here, we deal with the type of drilling we can expect through the Pennsylvanian-age beds which we class as medium-hard to hard.

In Lea County, New Mexico. Our company made a study of 48 wells drilled in a square of adjoining sections in an area between Jal and Eunice, N. M. Of the 48-well total, 15 we will not consider because they are not representative; some practice, such as a lot of coring, made these wells irregular.

All wells considered were drilled in the Permian section with the first medium-hard bit run on the second or third bit under the surface. The average well used 10 to 14 bits. Hardest rock bit used was a Hughes W7J or equivalent and all wells were drilled with a jet-bit program. Drilling fluid was water or natural mud with very little commercial mud added.

Table 3 summarizes the study; it shows average rates of penetration, feet drilled per bit, and bit cost per foot.

Rate of penetration for the slim holes was faster than for the 7⅞-in. holes. The 6¾-in. bits drilled very nearly as many feet each as did the 7⅞-in. bits. However, the 6¾-in. bits cost less per foot than did the 7⅞-in.

The 6¼-in. bits had a slightly faster drilling rate than the 6¾-in. or the 7⅞-in. bits. Unfortunately, the 6¼-in. bits drilled 28% fewer feet than the 6¾-in. bits and 33% less than the 7⅞-in. bits. Result was that bit cost was 30% higher with the 6¼-in. bit than for the 6¾-in.

What we learned. Our company drilled nine of the eleven 6¼-in. holes in this area. We chose the 6¼-in. size because we felt it offered a good chance to reduce well costs.

The first of these wells required a total of 154 rotating hours. The next well cut rotating time to 123 hours; the next to 115, the next to 109; then, to 105. From these results, we concluded that the key to drilling with the smaller bits is in the techniques of using them.

Contrary to what most believe, the bearings were not the weakest point in design of the 6¼-in. bit. Limiting factor was fast dulling of the teeth. We found that penetration was fast when the bits were fresh; rate dropped off rapidly as the bit dulled.

In running a medium-hard-to-hard bit, average run was cut from 12 to 8 hours. Bearing damage was rare while running, with 4,000 to 4,500 lb. per inch of bit diameter and rotary speeds from 60 to 100 r.p.m.

Rate of penetration was good in drilling salt and anhydrite. Moreover, the 6¼-in. bits drilled almost as many feet as the 6¾-in. bit.

In the future, we plan longer bit runs in the soft-to-medium-soft formations; the only green bits we pulled were in the soft sections.

Penetration rate was good in the medium-hard-to-hard formations but we made no real progress in increasing the feet drilled per bit. However, if rate of penetration decreased, we got no increase in feet drilled per bit.

Why the difference? Table 3 shows little difference in the feet drilled per bit with a 6¾-in. bit and with the 7⅞-in. size. On the other hand, there is a big difference between the 6¼-in. and 6¾-in. Why the difference? Bearings are no problem; failures have not been excessive. The weight in pounds per inch of bit diameter was roughly the same for each bit.

Tooth design on the same type bit is practically identical. Tooth depth on one type 7⅞-in. bit is ½ in.; on the same type bit of 6¾-in. size, tooth depth is ⅜ in. On the 6¼-in. bit it is 11/32 in. The greater difference in groove depth occurs between the 6¾-in. size and the 7⅞-in. size, not between 6¼-in. and 6¾-in.

Tooth width does not appear to be the cause; it varies within the bit on each cone. That is, on the three-cone bit, the outer row on a 7⅞-in. bit has a tooth width of 7/16 in. For a 6¾-in. bit, it is ⅜ in. And for a 6¼-in. bit, it is 5/16 in. With teeth of equal hardness, you would think that the three bits should drill very nearly the same number of feet if the same weight per inch of bit diameter is run. But, as we said, this isn't the case. The 6¾-in. bit matches the 7⅞-in. but the 6¼-in. does not perform in like manner in hard formations.

Number of teeth unequal. There is one principal difference between the 6¼-in. and 6¾-in. bit models of one major manufacturer—there is one less row of teeth on the 6¼-in. size. This means there is 20% less steel on bottom but the 6¼-in. bit cuts only 17% less hole area.

This is the only logical reason I know to account for the difference in penetration rates.

It is significant that we were able to cut our rotating hours from 154 to 105. This fact indicates that the techniques of weight and speed in running the smaller bits is very important. It is logical to conclude, therefore, that we simply haven't yet found the proper way to run the 6¼-in. rock bit.

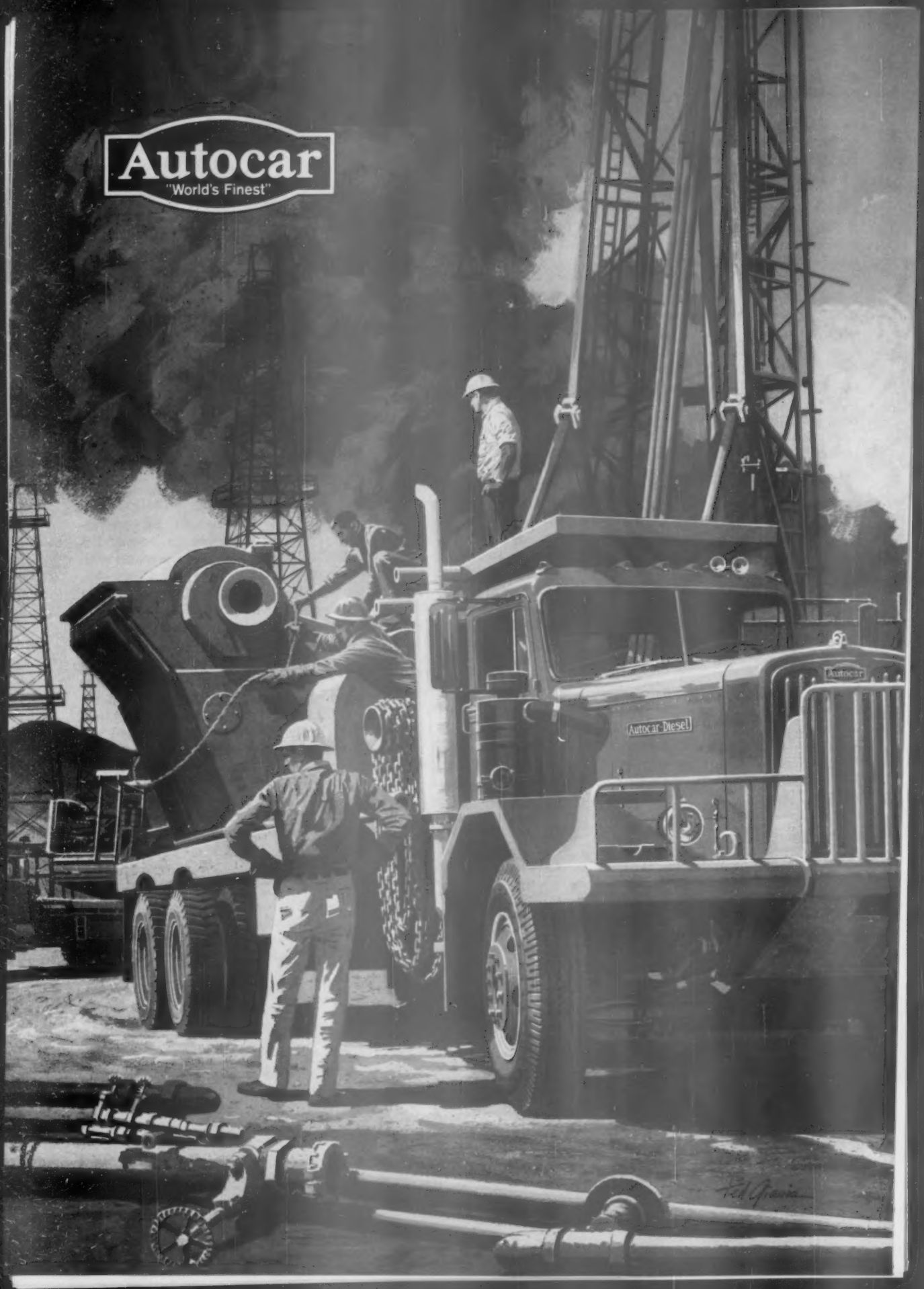
I am of the opinion that we should use the variable-weight and rotary-speed technique. It should improve the feet per bit performance. This technique uses less weight per inch of bit diameter with slow rotary speed on a new bit. Then, as the bit gets duller, weight and speed are increased.

Crooked hole a problem. In this area, the small-bore wells readily went off vertical, and it was often difficult to correct the situation. In the 6¼-in. hole, we alleviated the problem by running two 5½-in.-o.d. collars on bottom and using a rotating-type stabilizer one collar off bottom. These collars have a 5-in. fishing neck.

The typical drill string was 2⅞-in.-o.d., 6.5-lb. N-80 tubing. On this tubing, we used 4⅛-in.-o.d., 2⅞-in. IF tool joints of the screw-on type. We also used 22 drill collars of 5¼-in. o.d. and 2¼-in. i.d. These collars have a 5-in. fishing neck on the top 3 ft. of each so that a 6-in.-o.d. overshot works very well on them and there is room to washover in case of difficulty.

We now run 15 to 20 joints of 3½ or 4½-in.-o.d. drill pipe immediately above the drill collars. This heavy pipe helps avoid fatigue cracks in our drill tubing and it helps stiffen the assembly immediately above the drill collars.

The rigs our company uses for slim-hole drilling are mobile and light with nearly everything on wheels. In some cases, these units hardly resemble what a rig should look like.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"World's Finest"
Autocar Diesel
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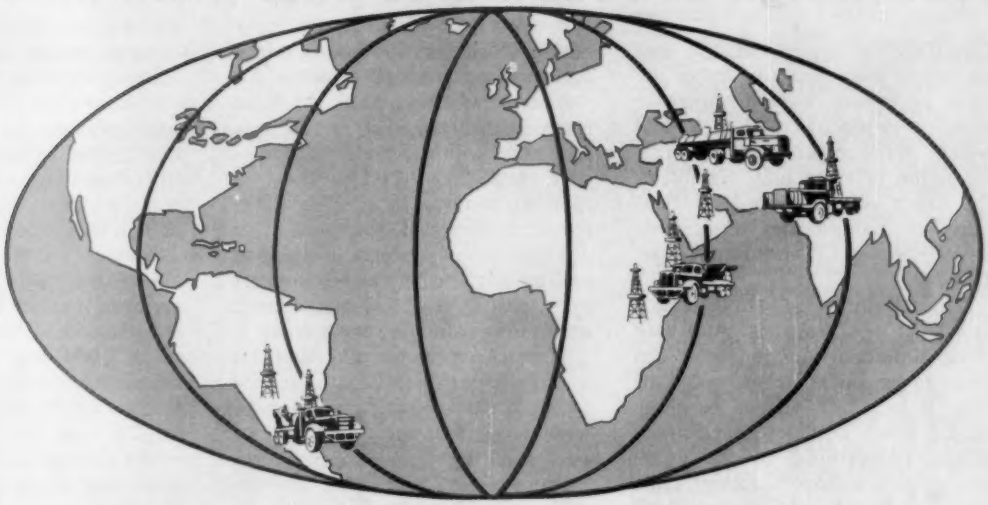


Wherever Americans drill for oil

they want Autocars ...nothing less

Oilmen specializing in foreign operations don't take chances. For instance, Southeastern Drilling (home headquarters, Dallas, Texas) uses Autocars in remote *Kuwait, Iran . . . Pakistan, Somaliland* and the *Argentine.* The Autocars move rigs, camps, pipe, and anything else that needs transporting.

Autocar performs. Autocar stays on the job. Autocar always does its share in making oil operations pay.

So it's just what you'd expect when American drillers, wherever they're working, say, "Send us Autocars. Nothing is too tough for them. They're right for the conditions we're up against everyday."

Autocar always custom-engineers. When you buy Autocars, *all* components are superbly engineered for the jobs they have to do. Men whose trucks must range far afield on their own, want Autocar — "World's Finest" — nothing less.

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

Processing notes

New weigh cell facilitates pilot-plant automation

EXTENSIVE instrumentation and control of pilot plants is one of the most promising ways to increase research productivity. A new tool which helps make better instrumentation of these units feasible is the weigh cell developed by Esso Research Laboratories of Humble Oil & Refining Co. in Baton Rouge, La.

The cell can weigh various liquids at typical unit pressures. And with some additional automation it can give an excellent record of flow rate. It is a null-balance weighing device which provides an electrical output proportional to the liquid contained in a supported weigh tank. The accompanying photo shows the weigh cell with the protective casing removed. The weighed tank is filled and emptied through coiled tubing which also serves as a minor part of a spring support system.

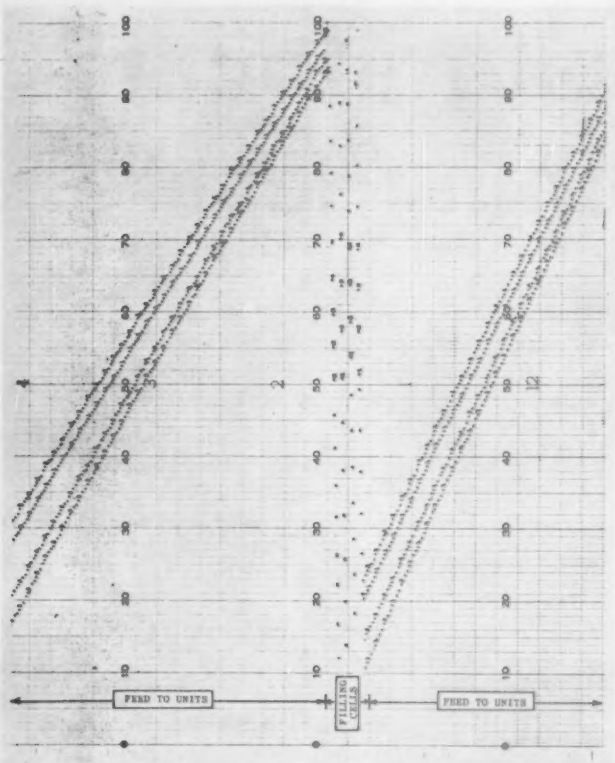
Underneath the tank is the main force spring (not visible) which is in contact with the tank and a support plate. This plate is made to move up or down by a ball bearing-mounted, threaded shaft which is driven through a worm and pinion by a motor. Thus the spring, support plate, gear system, and motor make up a tank-positioning force train.

A bracket near the tank supports a strain gage which is fitted with a spring-loaded sensing arm. Downward motion of the tank, such as occurs during dilling, exerts force on the strain-gage detector. The output signal from the strain gage, after amplification, drives the motor in such a direction that the force train described above exerts an opposing upward force on the tank.

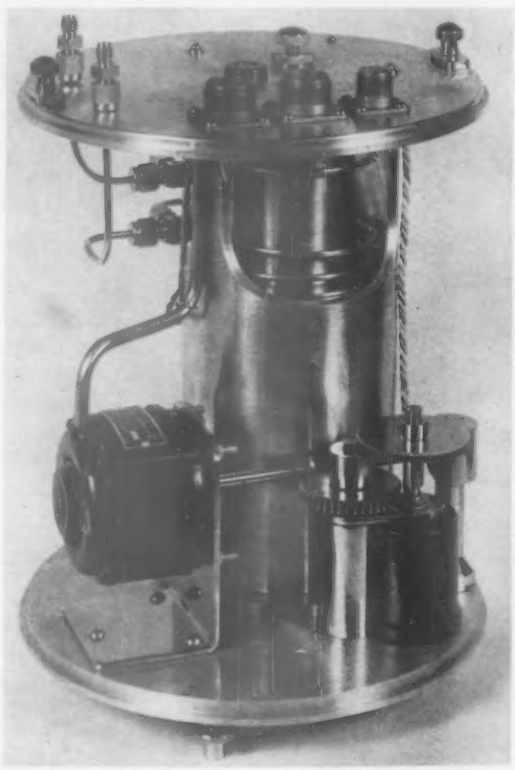
The gear drive of the force train is also coupled to a potentiometer which provides an electrical output proportional to the prevailing load. This closed-loop position measurement-and-correction is the secret of the cell's high sensitivity and good stability.

Sensitive unit. The weigh cell has been used in light-hydrocarbon and strong-acid service at pressures up to 2,000 psig. Under favorable conditions the 100-ml. size tank can detect a weight change of 1 mg. and the 2-l. size can detect a 10-mg. weight change. In normal unit operations the weigh cell has an overall reproducibility of about 0.2%.

The electrical signal from the weigh cell's retransmitting potentiometer can be sent to an indicator



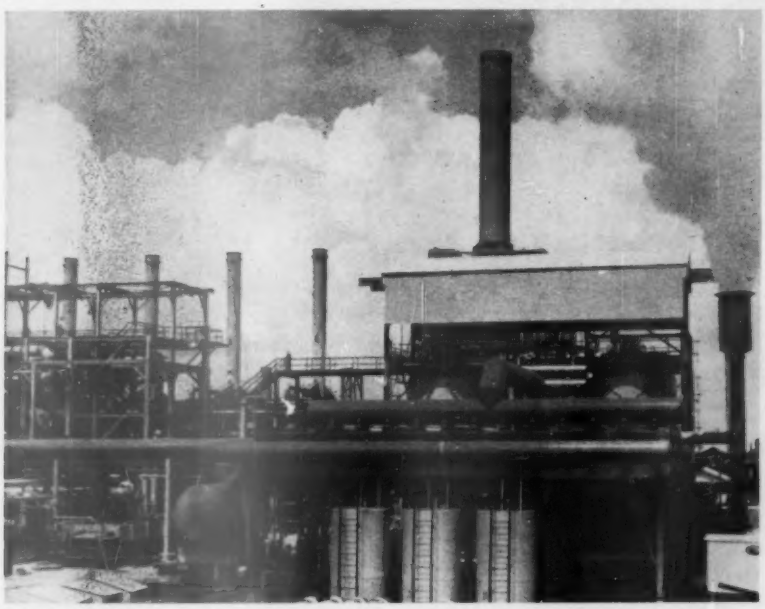
WEIGH-CELL RECORDS obtained using millivolt recorder. Slope of each line indicates feed rate from corresponding cell.



NEW WEIGH CELL provides basis for excellent record of flow rate in pilot plants.

or recorder. The chart shows a record of four weigh cells obtained using a standard millivolt recorder. Since the slope of each line indicates the feed rate from the corresponding cell, this representation gives a quick method of setting pilot-plant flow rates. Total weights of liquids handled are also shown by such recordings.

In order to maintain continuous pilot plant operations, it is desirable to make the weigh cell automatic. This can be done as follows: When the weigh cell is nearly empty, a lower-limit switch is tripped on the millivolt recorder or, alternately, on the gear-drive mechanism. This starts the refilling operation. When the refilling has been completed, a similarly located upper-limit switch returns the weigh cell to normal operation. During refilling (a small part of the total time) the liquid continues to flow but no indication or record is available.



NEW PLANT increases butadiene capacity 50%, to 133,000 long tons per year, at Copolymer Rubber & Chemical's Baton Rouge plant.

Copolymer becomes country's fourth-largest SBR plant

THE MAJOR part of a $5,000,000 expansion program is on stream at Copolymer Rubber & Chemical Corp., Baton Rouge, La. The program included additions to the butadiene and power plants and a new rubber production line. Foster Wheeler Corp. was the contractor.

The butadiene-plant expansion increases butadiene capacity about 50%. The new unit (photo) is the second commercial plant of the Dow catalyst process in the United States. The other U. S. plant is in Port Neches, Tex. Also, the Dow process is installed at plants in Fawley, England, and Sarnia, Ont.

Copolymer's new butadiene plant is highly automated. Elaborate interlocking and valve-switching controls insure maximum safety conditions for the operators.

A turbogenerator and 220,000-lb. per hour of added steam capacity provide steam for the new butadiene unit. The addition raises Copolymer's steam capacity to about 700,000 lb. per hour.

The new rubber-production line is designed to produce nonstaining rubbers of improved color without contamination. Copolymer now has six rubber lines and the addition makes it the country's fourth largest SBR plant.

The additions raise capacity from 95,000 to 133,000 long tons gross yearly.

Esso patents bacterial desulfurization method

PATENT on a novel method for removing sulfur from petroleum and refined products recently was granted to Esso Research & Engineering Co.

Strains of aerobic bacteria would be used to convert organic sulfur into inorganic compounds which would then be removed by chemical means. More effective and economical bacteriological methods have to be developed before the process can compete with processes now in use but some success has been achieved in the laboratory.

According to the patent (No. 2975103, with Isidor Kirchenbaum the inventor) the process consists of the following steps:

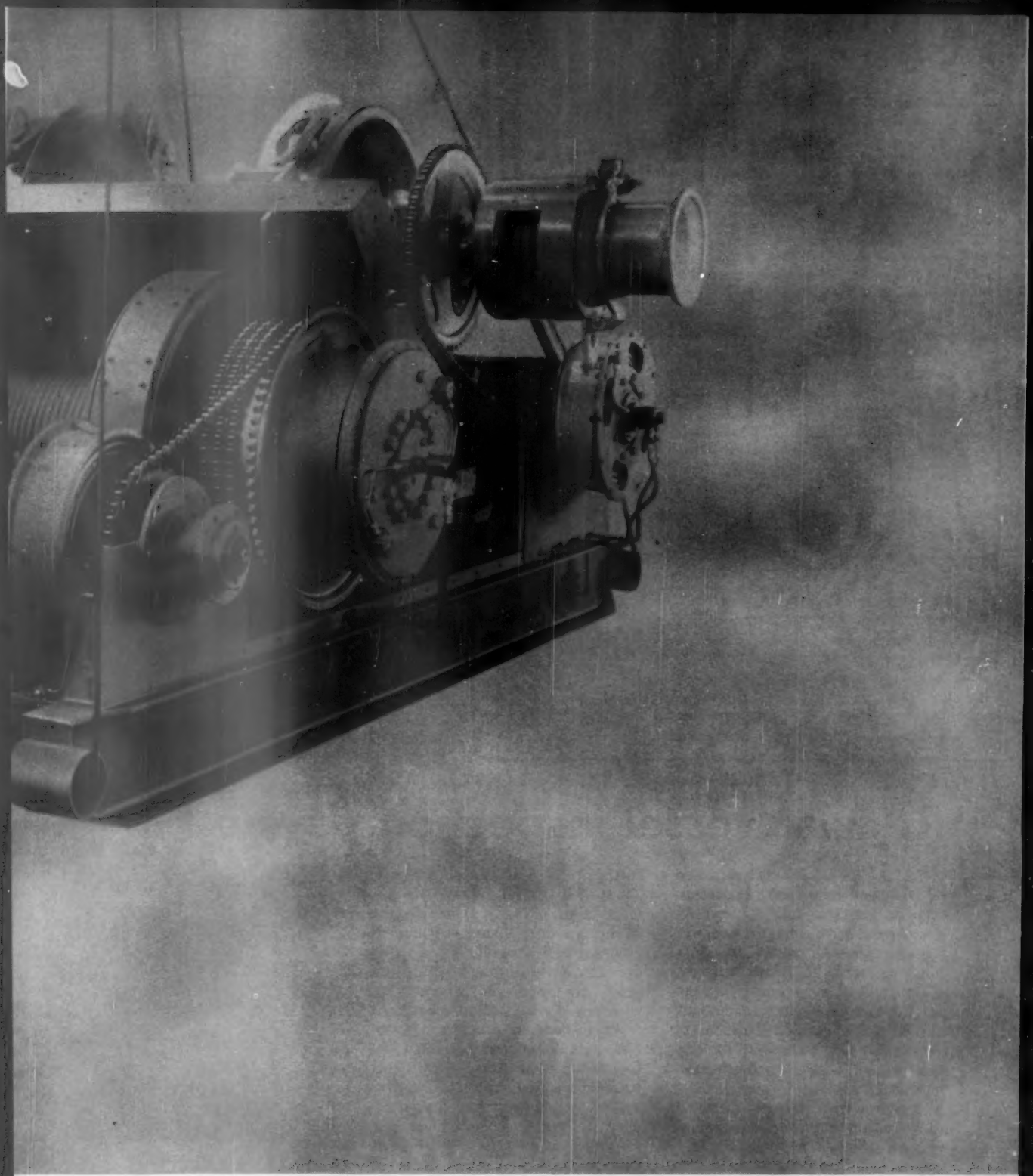
The petroleum fraction and an aqueous bacterial culture are separately introduced into a column packed with such materials as berl saddles, calcined silica, or calcined bauxite. Air also is introduced, with the mixed streams moving up the column at a rate which permits the desired degree of desulfurization to be attained by the time the streams leave the column.

Contacting of the hydrocarbon stream with the bacteria is carried out in the presence of a sulfur-containing surface-active agent which is consumed by the bacteria during the contacting phase. Possible agents include such compounds as sodium aryl alkyl polyether sulfonates (trade name Triton) and alkylated aromatic sulfonates. Concentration of agent used is preferably in the range of 0.1 to 0.2%, based on the water phase.

From the column the liquid stream is led to a settler where the mixture is separated into an oil phase and an aqueous culture layer. To control the pH and remove the sulfate formed during desulfurization, the aqueous layer is regenerated. One regenerating method used involves addition of an electrolyte having an affinity for sulfate ions, such as calcium oxide or barium hydroxide.

Under optimum conditions, over 90% of the sulfur contained in petroleum fraction may be removed in less than 10 minutes' contact time, the patent application stated.

Sikorsky S-64 Skycranes will carry loads 4½ times



greater than any helicopter in commercial service today.

The Skycrane, now being built, is a completely new helicopter specifically designed for lifting heavy loads. It will pick up and deliver nine tons of you-name-it . . . or carry field offices, tool sheds, kitchens, or nearly any other field unit in interchangeable pods. The Sikorsky Skycrane has power and versatility plus. Send for the complete story today.

Sikorsky Aircraft

Division of UNITED AIRCRAFT CORPORATION, Stratford, Connecticut

FIG. 1

PHILLIPS PETROLEUM COMPANY
Report of Field Pressure Vessel Inspection

Copies to:

To: Plant Superintendent — File: P-35-H

From: Equipment Inspector — Date of Report May, 1960

Plant & Unit A — Service Reflux – Accumulator

External or Internal Inspection Both — Date of Last Inspection June, 1955

Size 10' O.D. x 40' — Position Horizontal — Equip. Class. No. 95-51862 — PVI No.

Built by Flint Steel — Date 1951 — Mfr. Serial No. 8534 — AFE Item No.

Pressures: Orig. Design 385 psi. Current Operating 270 psi. Current Relief Valve Set 325 psi

Shell: Material A-212-Gr-A-FB — Orig. Tk. 1.4843 — Metal Loss .380 — Press. Eff. Tk. 1.1043

Head: Material A-212-Gr-A-FB — Orig. Tk. 1.4062 — Metal Loss .220 — Press. Eff. Tk. 1.2862

Type Elliptical — Ellip. Ratio 2:1 — Knuckle Radius (r)

Dish: — Inch Rise In — Inches — Dish Radius (L)

Joints: Long. Seam Welded — Circ. Seam Welded — X-Rayed Yes — Stress Relieved Yes

Dia. Rivet Holes — Pitch — Strap Tk: Int. — Ext.

Nozzles: Type W.F. — Series 30 — Reinf. Yes — Size 10"

W.F. — 30 — Yes — 12"

Manways: Type W.F. — Series 30 — Reinf. Yes — Size 18"

Patches: Size, Location and Type Joint None

Corrosion Description Pitting and general corrosion in bottom involving 1/5 of the circumference plus two hydrogen blisters.

Rating: Vessel Rated In Accordance With 1959 ASME Code

Max. Allow. Press. (Max. R. V. Set) 301 psi @ 625 °F With no Corr. Allow.

Hydro. Test Press. — Date — Rating Governed By Shell

Following repairs have been made to maintain this rating: None

Remarks – Recommendations: Re-inspect within 6 months because of hydrogen blisters found.

Inspected By Equipment Inspector — Dept. Natural Gasoline — Date of Insp. May, 1960

Recommended Date of Next Inspection

Form 2432 12-60

FIG. 2

CALCULATIONS

(Based on 1959 ASME Code Formulas)

SHELL

Joint Efficiency = E = 100 % — Allowable Stress = S = 16,250 PSI

Inside Diameter = D = 117.8 Inches — $P = \frac{2SEt}{D+1.2t}$ = 301 PSI

HEADS

Joint Efficiency = E = 100 % — Allowable Stress = S = 16,250 PSI

FLANGED AND DISHED (TORISPHERICAL)

$\frac{L}{r}$ = — Factor M = — $P = \frac{2SEt}{LM+.2t}$ = — PSI

ELLIPSOIDAL

Axis Ratio 2:1 — Factor K = 1 — $P = \frac{2SEt}{KD+.2t}$ = 353 PSI

HEMISPHERICAL

$P = \frac{4SEt}{D+.2t}$ = — PSI

CONICAL

α = — α Cosine α = — $P = \frac{2SE\ t\ Cos\ \alpha}{D+1.2t\ Cos\ \alpha}$ = — PSI

Where: P = Maximum allowable pressure; design pressure, psi
S = Allowable unit stress for material, psi (Page 79)
E = Joint efficiency (Page 52)
t = Metal thickness, inches
D = Inside diameter, inches
L (Previously R_1) = Inside crown radius, inches
r (Previously R_2^c) = Inside knuckle radius, inches
M (Previously W^T) = Head factor depending on L/r ratio (Page 123)
K (Previously V) = Head factor depending on axis ratio (Page 123)
α = One-half of the included (apex) angle of conical heads
(Page references are to 1959 ASME code)

Additional Remarks:

INSPECTION REPORTS become a permanent record for the life of the vessel. Fig. 1 and 2.

Regular vessel inspection pays off

INTERRUPTED operations caused by leaks and failure of process vessels are dangerous and costly. Phillips is reducing this hazard and cost by a periodic internal vessel inspection program in its natural-gasoline plants. This is being done by assigning full-time inspectors to the job, and making the vessels available for inspection. Inspectors look for corrosion, faulty welding and other defects, and excess-pressured vessels. This allows for corrective measures to be taken before failures occur that necessitate crash shutdowns.

This full-scale program to include all vessels at natural gasoline plants was begun in 1959. However, an initial program to inspect only pressure vessels was started on a limited basis some 10 years previously.

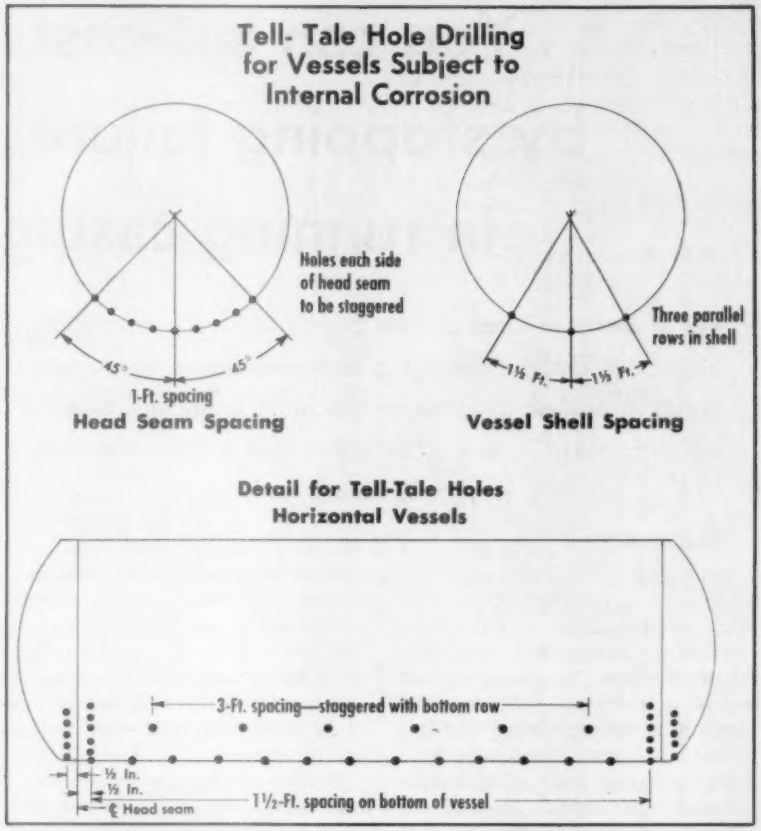
Beginning of the vessel-inspection program in the natural-gasoline department at Phillips was brought about in a painful manner—equipment failures. Down time in some of the processing plants became so excessive that something had to be done. A decision was made to develop an inspection program for vessels and related equipment.

As inspections progressed, troubles were found and corrected before failures occurred. The benefits of an inspection program began to unfold. Operators had more assurance that their equipment was safe; process capacities and operating efficiency were often improved as a result of cleaning and repairs to bubble caps, chimneys, trays, liners, etc. More inspectors were added and the program was expanded.

With data that were accumulated on corrosion and erosion in vessels being inspected, it was apparent the program should be further ex-

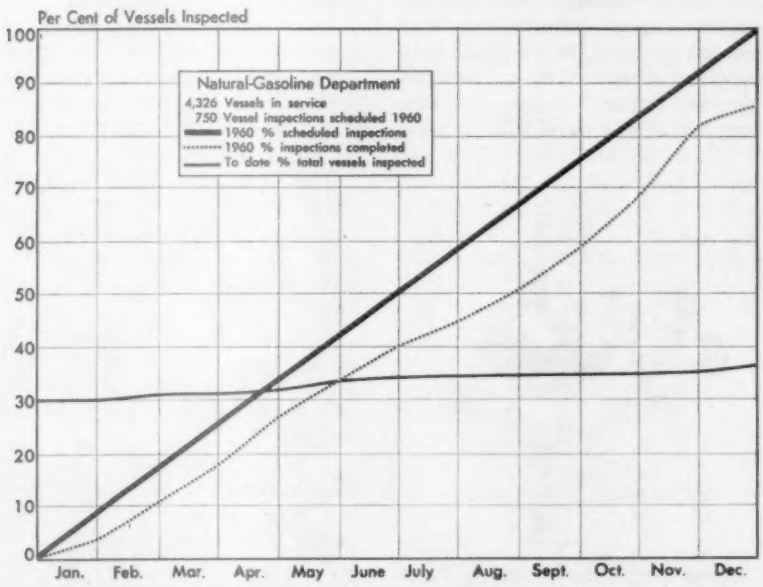
BY V. J. WHITEHORN

. . . safety director for the natural-gasoline department, Phillips Petroleum Co., Bartlesville, Okla. While working in operations he attended Capitol Hill Junior College in Oklahoma City. He was promoted to safety director in the Oklahoma district in 1948. Before promotion to his present job in 1957, he was safety director for the Panhandle district in Phillips, Tex.



TELL-TALE HOLES provide a safe leak if metal loss should occur at a rapid rate between inspections. Fig. 3.

panded to include all vessels. In 1959 an objective was set to complete inspections on all vessels within a 7-year period. At this time there were current inspection reports on 25% of more than 4,000 vessels located in New Mexico, Louisiana, Oklahoma, and Texas.



INSPECTIONS on all vessels are supposed to be complete within a 7-year period starting in 1959. Fig. 4.

Current inspections were considered to be those which had been completed within the past 5 years. Seven full-time inspectors and one half-time inspector are now assigned to this work, with a hundred vessels and related equipment scheduled for each inspector annually.

It is not necessary that the vessel inspectors be metallurgists. However, a good knowledge of metals, vessel design, and welding procedures is necessary. When special problems arise which require detailed knowledge in metallurgy, assistance is obtained from the metallurgical engineer in the engineering division of the natural-gasoline department or the engineering department test division.

Inspection data sheets, as shown in Figs. 1 and 2, are prepared on each vessel when inspected. These and all future inspection reports become a permanent record.

Visual inspection is still one of the most dependable methods of inspection. However, there are many good tools in use at Phillips to aid the inspector. Those most commonly used are: pit-depth gage, thickness gage, hammer, tape measure, and caliper. To aid in detecting small defects and cracks open to the surface, dye penetrants and magnetic-particle inspections are made. For onstream inspection and the detection of subsurface defects, ultrasonic instruments are used.

On some vessels known to be in severe corrosive service, small ⅛-in.-diameter tell-tale hole patterns are drilled partially through the vessel shell from the external side as shown in Fig. 3. Vessels designed for corrosive service are normally built with extra metal thickness in the shell and heads known as corrosion allowance. This is in addition to the thickness required to hold the internal pressure. The depth of the tell-tale holes is usually through the thickness required to hold the pressure, leaving the corrosion allowance undrilled. Some conditions might dictate different depths. This provides a safe leak if metal loss should occur at a rapid rate, between inspections.

To keep department management advised of the progress of the vessel-inspection program, charts are kept current by the department safety director (Fig. 4).

You can cut costs by stopping failures in running casing

Many costly failures can be prevented by good supervision. A good example is in running casing strings; here's a review of some of the most important details which can easily make the difference between success and failure in a well completion.

BY NEIL G. OWENS
Midwest Oil Corp., Midland, Tex.

NOT LONG AGO, an independent operator was heard to boast that he does not "waste" money on engineering supervision of his field operations. He leaves this up to the drilling contractor and the service companies.

This man is plagued by field failures which he passes off as "bad luck." Most of the time it is not bad luck at all. It is almost entirely a result of mistakes and inattention to detail by the various people performing the operations. The cost of just one such failure would pay for good supervision of all this man's field operations and prevent 90% of his trouble.

Almost any man with a little common sense can get a string of casing into the hole or perform a drill-stem test or squeeze-cementing operation in a sloppy, haphazard, and costly manner. But it takes a conscientious, experienced, well-trained man to do the job right and reduce risk to the barest minimum. If you have such men in your organization, reward them and be thankful. They are making the company more money than probably anyone realizes.

The difference in salary for a man incompetent to do the job and one thoroughly competent does not exceed $2,400 a year. One casing failure or one badly run drill-stem test in a deep hole will make up this difference many times over.

More and more economy-minded companies have retired old practical field foremen and turned loose higher-salaried experienced engineers. As this happens, the percentage of unsuccessful completion attempts rises, even on proven oil and gas formations. Some producers have more than their share of such troubles as unsuccessful primary cementing, casing and tubing failures, drill-stem-test failures, and rod-and-pump malfunctions on pumping wells. Quite often these things are the result of sending untrained and inexperienced personnel to supervise operations on the well.

Before we assign some unsuccessful field operation to "bad luck" or "events beyond control," we must ask this question: Would there have been a failure had proper supervision been present? There is only one way for a man to qualify to conduct field operations and that is by actual field training under a qualified, successful field man.

"Casing should be inspected to insure that various weights and grades are in proper place on the rack."

What to watch for. Here we are concerned with the details of running casing and with what we must do to reduce risk to the minimum. Of course, any time equipment is run into a hole in the ground, there is a risk inherent in the operation. Below we will consider what an experienced supervisor will watch for to eliminate much of the risk.

Even before field operations begin, the casing string must have been properly designed for the depth to which it will be run and for the pressures it will encounter. The proper kind and amount of cement must have been selected. After these things have been done, the next step is to properly perform the mechanical operations of planting this casing string in the ground.

This, then, is a check list of the important operations most overlooked and quite likely to cause failures. The operations are in the order in which they should be performed.

1. Casing should be inspected to insure that various weights and grades are in the proper place on the rack so that the pipe will be run as designed.

2. Give instructions that no thread protectors be removed until just before pipe is run. It is appalling how many times the protectors are removed from the collars a week in advance of running and wind-blown sand is allowed to

"Give instructions that no thread protectors be removed until just before pipe is run."

contaminate the threads. Result can be that the pipe is run without proper makeup because the sand causes thread galling. If a casing part results, everyone concerned shrugs his shoulders and considers it "the luck of the business." It was not luck, but neglect or ignorance of the company man on the job.

3. Look through every joint to make sure there is no obstruction to prevent free circulation when the pipe gets to bottom. Even blowsand, that has been hardened by rain water, has been known to prevent circulation, and dead rabbits or boards wedged in a joint have

"Look through every joint to make sure there is no obstruction to prevent free circulation when pipe gets to bottom."

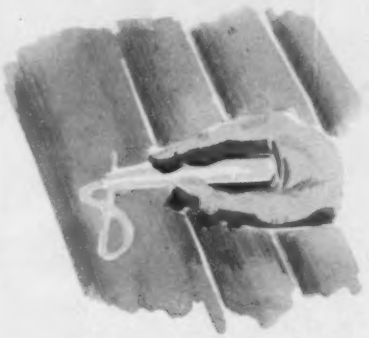
caused many casing drillout operations.

4. Number each joint with clearly legible paint or chalk, and then recount to make certain of the exact numbering.

5. Tally the joints in the order in which they will be run. This should be done personally, and not left up to the driller or tool pusher. Many wells have been lost when the casing was not bottomed at the right place because of improper tallies. Even though casing is to be run to bottom, an accurate tally is necessary so that if the pipe should stop going at some spot off bottom, the proper steps can be taken. The man responsible for the accurate tally should not only have each measurement called out, but he should also stand behind the man reading the tape and visually check each call. This should be done carefully and without haste, even though it involves shutting the rig down temporarily. It must be done right. There can be no check after the pipe is run into the hole.

6. Inspect each joint for visible surface defects.

7. Just before running operations commence, look through each joint



"Number each joint with clearly legible paint or chalk, and then recount to make certain of the exact numbering."

again and inspect rack for proper sequence of weights and grades. It is impossible to overemphasize this step. Have the thread protectors removed from the collars. The threads should then be cleaned and inspected. Inspect and clean the threads in the other end and replace the cleaned protectors.

8. Personally inspect floating equipment for defects and proper makeup on casing. Inspect and direct all welding. Under no circumstance allow a bead to be run completely around the casing. Keep the weld tacks short in length, and have the welder run a heavy bead. Better still, use the new thread-lock compounds to permanently connect the three bottom joints together, and eliminate all welding on the casing.

9. Have each thread lubricated

"Tally the joints in the order in which they will be run. This should be done personally."

after it is catheaded to the floor. Many times the collars are lubricated while still on the rack, and the thread compound serves only as a base to catch dirt as the joint is moved to a dirty catwalk.

10. Use power tongs for makeup. Be sure that the proper torque for the casing size is put on each joint, and direct both the tong operator and the driller to visually inspect each joint after it is made up. The company man should stay on the floor as much as possible to make sure that these instructions are carried out exactly. If a joint does not make up properly, it should be reversed out, cleaned, relubricated, and the makeup tried again. If it does not make up properly the second time, discard both joints. It is surprising how many drillers run a joint into the hole with three or four threads still exposed, just because the torque specified by the operator was put on the joint.

11. When the casing is landed, it

"Inspect each joint for visible surface defects."

should be circulated long enough to be certain that enough mud has been pumped to completely clear the casing of any foreign matter. It is costly and completely unnecessary for the float to plug when all or only part of the cement has been mixed, and the cement has not even reached the float.

12. The cementing company should be directed to check and double-check the volume of the fluid it pumps to displace the cement. The volume of the casing from plug container to float should be calculated by both cementer and operator to avoid any error. Exact measurement is vital should the plug fail to leave the plug container or be bypassed by the displacement fluid.

38. How to determine

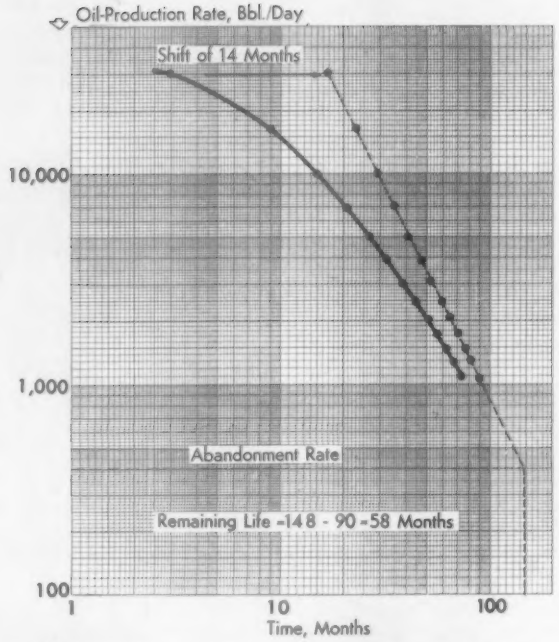
Performance and ultimate recovery of a reservoir declining hyperbolically

BY E. T. GUERRERO

GIVEN: Data shown in columns 1, 2, and 3 of Table 1 obtained from a lease producing from the Arbuckle lime in Kansas.

FIND: Reserves and remaining economic life to an abandonment rate of 2,400 bbl. per half year using analytical and graphical methods.

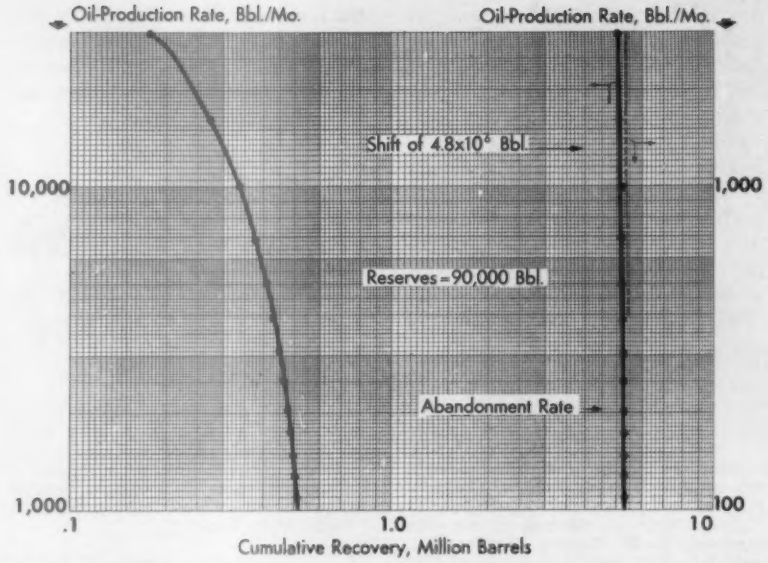
METHOD OF SOLUTION: The equations on the next page relate production, time, and cumulative recovery:



VARIATION of oil-production rate with time for Arbuckle limestone lease. Fig. 1.

TABLE 1—PRODUCTION DATA AND COMPUTATION OF DECLINE

(1) Date	(2) Time, months—Total	(3) Time, months—Average	(4) Oil prod. rate, q_o bbl./mo.	(5) Δq_o $(4)_{n-1} - (4)_n$ bbl./mo.	(6) $\frac{q_{o(av)}}{\frac{(4)_n + (4)_{n-1}}{2}}$ bbl./mo.	(7) Monthly loss ratio $-a = \frac{q_{o(av)}}{\Delta q_o/\Delta t}$ $\Delta t = 6$ mo.
1/52	6	3	29,500			
7/52	12	9	16,100	13,400	22,800	10.21
1/52	18	15	9,910	6,190	13,005	12.61
7/53	24	21	6,820	3,090	8,365	16.24
1/54	30	27	5,015	1,805	5,918	19.67
7/54	36	33	3,855	1,160	4,435	22.94
1/55	42	39	3,050	805	3,453	25.74
7/55	48	45	2,475	575	2,763	28.83
1/56	54	51	2,050	425	2,263	31.95
7/56	60	57	1,720	330	1,885	34.27
1/57	66	63	1,465	255	1,593	37.48
7/57	72	69	1,263	202	1,364	40.51
1/58	78	75	1,099	164	1,181	43.21
Future Performance						
7/58	6	3	965	134	1,032	46.21
1/59	12	9	854	111	910	49.21
7/59	18	15	761	93	808	52.21
1/60	24	21	683	78	722	55.21
7/60	30	27	616	67	650	58.21
1/61	36	33	558	58	587	61.21
7/61	42	39	508	50	533	64.21
1/62	48	45	465	43	487	67.21
7/62	54	51	427	38	446	70.21
1/63	60	57	393	34	410	73.21



VARIATION of oil-production rate with cumulative recovery for Arbuckle limestone lease. Fig. 2.

$$a = -\frac{q_o}{dq_o/dt} \approx \frac{-q_{o(av)}}{\Delta q_o/\Delta t} \quad (1)$$

$$b = da/dt \approx \Delta a/\Delta t \quad (2)$$

$$q_o = q_{oi}\,(1 + bt/a_o)^{-1/b} \quad (3)$$

$$\text{at } t = o \quad a = a_o \quad (4)$$

$$N_p = \frac{(q_{oi})^b\, a_o}{1 - b} \times [(q_{oi})^{1-b} - (q_o)^{1-b}] \quad (5)$$

Where:

a = loss ratio.

q_o = oil-production rate at some time t.

t = time.

b = first derivative with respect to time of loss ratio.

q_{oi} = oil-production rate at zero time.

a_o = loss ratio at zero time.

N_p = cumulative oil recovery from zero time.

OF KANSAS ARBUCKLE LIMESTONE LEASE

(8) Δa	(9) First derivative of loss ratio, $b \approx \Delta a/\Delta t$ $\Delta t = 6$ mo.	(10) Incremental recovery, bbl., (4) × 6	(11) Cumulative oil recovery, bbl.
...	...	177,000	177,000
...	...	96,600	273,600
2.40	0.400	59,460	333,060
3.63	0.605	40,920	373,980
3.43	0.572	30,090	404,070
3.27	0.545	23,130	427,200
2.80	0.467	18,300	445,500
3.09	0.515	14,850	460,350
3.12	0.520	12,300	472,650
2.32	0.387	10,320	482,970
3.21	0.535	8,790	491,760
3.03	0.505	7,578	499,338
2.70	0.450	6,594	505,932
	5,501		
	$b = 5.501 \div 11 = 0.500$		
Future Performance			
3.00	0.500	5,790	511,722
3.00	0.500	5,124	516,846
3.00	0.500	4,566	521,412
3.00	0.500	4,098	525,510
3.00	0.500	3,696	529,206
3.00	0.500	3,348	532,554
3.00	0.500	3,048	535,602
3.00	0.500	2,790	538,392
3.00	0.500	2,562	540,954
3.00	0.500	2,358	543,312

SOLUTION: The solution to this problem is shown in Table 1. For July 1955:

$$a = \frac{2{,}763}{(3{,}050 - 2{,}475)/6} = 28.83$$

$$b = \frac{28.83 - 25.74}{6} = 0.515$$

For the future performance, factor b is constant at 0.500 and Δa is constant at 3.00. From these factors and Equation 1 the future performance data are determined. For example the rate for July 1961, is:

$$64.21 = \frac{(558 + q_o)/2}{(558 - q_o)/6}$$

from which:

$$q_o = 508$$

Equation 3 could also be used to obtain the future rates. Letting:

$q_{oi} = 1{,}099$ bbl./mo.
$q_{o\,(abnd)} = 400$ bbl./mo.
$b = 0.500$.
$a_o = 43.21$.

and solving Equation 3 the remaining life is obtained:

$$400 = 1{,}099 \times \left[1 + \frac{(0.500)\,(t)}{43.21}\right]^{-1/0.5}$$

and $t \approx 57$ months.

This compares well with the 58 months found graphically in Fig. 1 and slightly less than 60 months computed in Table 1.

Remaining reserves are found using Equation 5:

$$N_p = \frac{(1{,}099)^{0.500}\, 43.21}{1.000 - 0.500} \times [(1{,}099)^{0.500} - (400)^{0.500}]$$

$$N_p = 37{,}871 \text{ bbl.}$$

From Table 1 the reserves are 543,312 − 505,932, or 37,380 bbl. These two compare well but deviate considerably from the value of about 90,000 bbl. in Fig. 2. Note that

the curve had to be shifted considerably before it became straight. In so doing it developed a very steep slope and moved to a region of high cumulative recovery values. Thus it became very insensitive to error and interpretation.

DISCUSSION: The hyperbolic or log-log type of decline is claimed by Arps[1,2] to occur most frequently. In this type both the rate-time and rate-cumulative recovery relationships are nonlinear on log-log plots, Figs. 1 and 2. An easier method of recognition is afforded by the loss ratio "a" defined by Equation 1. In column 7 of Table 1 it was computed with the approximate form of Equation 1.

Note that the loss ratio increases uniformly with time. This is an indication that the production may be declining hyperbolically. If the loss ratio remains essentially constant, the decline is exponential.[3]

Factor b is defined by Equation 2 and represents the first derivative of the loss ratio with respect to time, column 9, Table 1. Notice that it remains essentially constant around 0.500. This tendency of the b factor to remain constant shows that the decline is hyperbolic. When this factor is equal to 1, the decline is referred to as harmonic.

The analysis of hyperbolic decline-type curves is based on these assumptions: (1) the lease must have been producing at capacity, and (2) future trends will be the same as past trends.

In this problem 6-month production intervals were used to eliminate monthly fluctuations by using the general trend of the decline. The problem has been solved both analytically and graphically to show and compare the two approaches. Calculated future performance is shown in Table 1, remaining life and reserves have been found using Equations 3 and 5, and graphical solutions are shown in Figs. 1 and 2. Note in the figures that both curves had to be shifted in order to straighten them out. Values for remaining life found by the two methods agree quite well. However, this is not true in the case of reserves.

Analytical solution showed that some 38,000 bbl. of oil remain to be produced while graphically a value of more than 90,000 bbl. was obtained. In this case the graphical value is not reliable because of the steepness of the curve and its insensitivity to error.

Of the two methods used in solving this type problem, the graphical is more convenient and generally used. Except for special conditions, as in this problem, the graphical method is as accurate as the analytical approach. The latter method is useful in showing the type of decline through the computation of the loss ratio. It would also be preferred in machine computations. When time permits, both methods should be used in order to use one as a check on the other.

References

1. Arps, J. J., "Analysis of Decline Curves": Trans. AIME (1945), 160, 228.
2. Arps, J. J., "Estimation of Primary Oil Reserves": Trans. AIME (1956), 207, 182.
3. Guerrero, E. T., Part 37 of this series, The Oil and Gas Journal, May 22, 1961, p. 86.

BOOKS

THE USE AND INTERCHANGEABILITY OF FUELS IN PENNSYLVANIA. Published by College of Mineral Industries, Pennsylvania State University, University Park, Pa. 46 pp. $1.

This bulletin of the mineral industries experiment station, Number 47, 1961, deals with the use of fuels in Pennsylvania, and petroleum's relationship to other fuels.

HANDBOOK OF ORGANOMETALLIC COMPOUNDS. Compiled by Herbert C. Kaufman. Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 1,546 pp. $22.50.

Data on some 12,000 compounds, their physical, chemical, and thermodynamic properties, are brought together in this handbook conveniently arranged under each element within a periodic group. Individual compounds are easily found by their empirical formlas.

For each compound information is given including formula, name, molecular weight, state of aggregation, solubility, refractive index, density, vapor pressure and many other properties available. An extensive bibliography follows each element within a periodic group covering material of supplemental interest outside of physical constants.

Greater convenience in use is provided by grouping compounds in chapters according to the metal or other element which constitutes the central atom; and within each chapter by arrangement essentially in order of increasing carbon content, followed by the other elements. In addition, wider usefulness is enhanced by the inclusion of many related nonmetallic compounds such as sulfur, phosphorus and nitrogen.

HISTORY OF PETROLEUM ENGINEERING. Published by API, 300 Corrigan Tower Bldg., Dallas. 1,241 pp.

This big volume covers exhaustively the history and present scope of petroleum engineering.

Divided into five books—introductory and general, drilling and completing wells, producing and handling oil and gas, notable cooperative efforts, and conclusion. Each book in turn is divided into a number of separate works, making 21 in all for the volume.

Beginning with "The Energy Revolution," and "Concepts on Occurrence of Oil and Gas," the history discusses "Sources of Men," and "Evolution by Companies."

Next are articles on percussion drilling, hydraulic and pneumatic rotary drilling, cementing, logging, sampling, testing, and completion methods.

This is followed by discussions on production equipment, production techniques and control, reservoir engineering, fluid injection, thermal, solvent, and improved gas-drive oil-recovery methods, handling oil and gas in the field, evaluation, research, conservation, unitization, and standardization of oil-field equipment.

The book concludes with a piece on "Impact Upon Society."

ASM REVIEW OF METAL LITERATURE, 1960. Edited by Marjorie R. Hyslop. Published by ASM, Metals Park, Ohio. 1,342 pp. $25.

This volume contains 11,903 annotations of articles, technical papers, reports and documents appearing in engineering, scientific, and industrial journals and books throughout the world during 1960.

The book is divided into 20 sections covering different areas of materials and process engineering and technology, and includes addresses of publications as well as comprehensive subject and author indexes.

TECHNICAL GLOSSARY OF THE PETROLEUM INDUSTRY—GLOSARIO TECNICO DE LA INDUSTRIA DEL PETROLEO. Published by Instituto Argentino Del Petroleo, Av. Santa Fe 1145, Buenos Aires, Argentina. 523 pp. $10.

This bilingual technical dictionary gives the Spanish and English equivalents for 20,000 words and terms associated with the petroleum industry.

This second addition has kept pace with the industry, including 3,000 new terms brought into being with new developments in sedimentology, pipeline construction and operation, petrochemistry, and other branches of the petroleum industry.

SAFE HANDLING OF LIGHT ENDS. Published by American Oil Co., Whiting, Ind., 89 pp. Fifty cents.

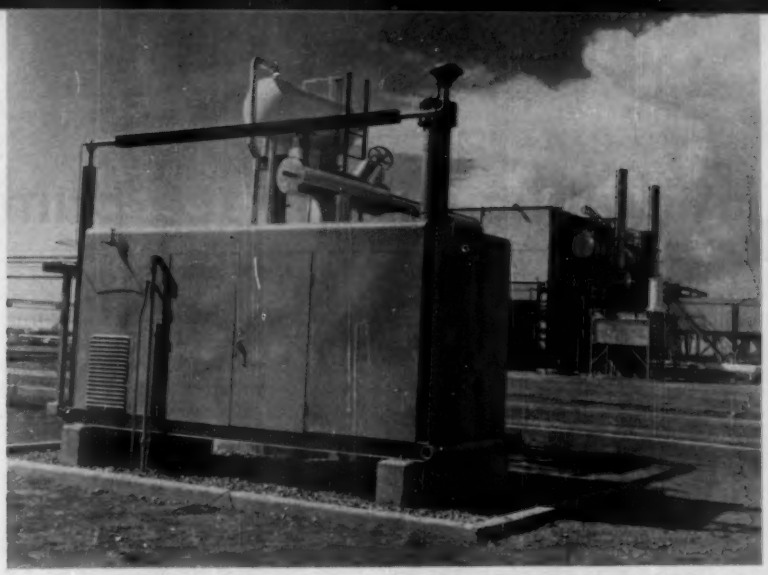
Booklet deals with safe methods for processing, storing, and loading hydrocarbons having a Reid vapor pressure of 18 psi. or more. The fifth in a series on process safety, the booklet is well illustrated and easy to read.

It is intended to supplement operator-training courses and operating manuals which give specific instructions on the proper handling of light ends. Fundamental characteristics of light ends are explained as well as the operating principles required for safe handling.

Orders should be addressed to John E. Engler, Supervisor of Safety, American Oil Co., Whiting, Ind.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

Freezing hazard avoided with azeotropic mixture



SELF-OPERATED, self-contained steam generating unit provides heat both for the station and for warming engine fuel gas at main-line compressor stations of Transwestern Pipeline Co.

COMPRESSOR STATIONS on the Texas-to-California system of Transwestern Pipeline Co. are heated by self-operated, self-contained compact steam generators. These units also provide the heat needed to warm fuel gas as it enters the stations' low-pressure lines.

Subfreezing temperatures present no hazard—even during shutdown—although the boilers are located outdoors and condensate returns through 250 ft. of exposed pipe. Transwestern adopted an answer suggested by Gulf Interstate Co. to solve the freezing problem that has plagued other lines. Transwestern uses a heat-transfer medium that forms an azeotropic mixture with water and also protects against freezing.

The azeotropic mixture, once formed, cannot be separated by boiling; thus the vapor composition is exactly the same as the bulk fluid. Because of this unusual property, freeze protection is obtained throughout the system.

Heat-transfer medium. The heat-transfer medium, known chemically as 1-methoxy-2-propanol and trademarked Dowtherm 209, forms the azeotrope when combined with water in the concentration range of 40 to 60 wt. %. Pour points for the mixture range from —18° F. for a 40% solution to —80° F. for one of 60%.

Unattended steam generators manufactured in Houston by Texsteam Corp., a subsidiary of Vapor Heating Corp., add a cost-saving refinement to a system that probably is unmatched for its high degree of automatic operation.

The four compressor stations now in service on the 645-mile main line all are operated by the remote control of a dispatcher in Roswell, N. M. For problem solving, the dispatcher has the assistance of an analog computer whose circuits incorporate the characteristics of the Transwestern system.

Customarily, boilers have been housed inside stations to prevent freezing of the condensate return. During shutdowns, the systems had to be drained. Breakdowns could bring freezeups. Steam tracing was a pesky process. If the boilers were located outdoors, subfreezing temperatures always were a potential danger, and the units had to be checked frequently.

First major use. The Transwestern system represents the first major use of Dowtherm 209 in this application, according to the Dow Chemical Co. The product, introduced in 1958, originally was formulated for ebullient cooling of large stationary engines.

Makeup of the heat-transfer medium has averaged about 5 gal. monthly for each 600-gal. unit. Makeup requirements are relatively small compared with older systems that require large quantities of treated water.

The economies in construction were even more significant, although still secondary to the fact the freeze-protected units facilitate operating the stations unattended.

Saving $15,000. Gulf Interstate Co. estimated at $15,000 per unit the initial saving in putting the boilers outdoors instead of inside in a utility room. Insulation was eliminated, and installation was simplified in that the steel-based boilers were loaded directly onto a pair of concrete supports.

The main contribution of a maintenance department is to find ways and means of changing methods to reduce operating costs. Indications are that repairs will be routine and confined to normal wear and tear.

Transwestern now operates four 7,000-hp. compressor stations on its main line, an identical station on its West Texas lateral, and booster stations of 2,640 hp. and 1,740 hp. on its gathering systems. The 7,000-hp. stations have 100-hp. steam-generating units. One booster station has a 70-hp. unit and the other has a 25-hp. unit. The steam generators all operate at low pressure, 15 psi.

Few modifications were necessary to make the forced-circulation boilers suitable for the heat-transfer medium. Because of the azeotropic mixture's lower heat of vaporization, the evaporation rate was increased. Also, all brass fittings were replaced by iron.

Added to the units was an ingenious wiring system. When a component fails, a light designates the culprit. Thus, even in time of malfunction the system clings to its push-button motif.

Hydraulic subsurface pumping (continued)

BY JOSEPH ZABA

IN THE preceding two installments, types and characteristics of the commercially available subsurface hydraulic production units and of the hydraulic pumping systems were discussed. It would appear that this discussion could form a basis for comparison of sucker-rod and hydraulic subsurface pumping. However, no generalized comparison can be made because many factors affect the economic performance of a given pumping method under any given set of conditions. A most careful analysis is needed in each case before a choice can be made.

Characteristics of the well and fluid, pumping depth, and volumes of fluid to be lifted are obvious considerations. For instance, if the produced fluid contains fine sand or large volumes of water, preference may be for beam pumping unless the hydraulic closed system is feasible. Conversely, if very large volumes have to be pumped from great depths, hydraulic pumping would be the choice because of the load limitations of sucker rods. With the present trend toward small-diameter production strings, space may be the controlling factor for a given set of conditions.

The shape of the lease, the well spacing, the terrain, and the climatic conditions are important when deciding between individual beam installations and the central hydraulic system. The degree of diversity of lease ownership in a given field may be of importance because in hydraulic pumping, except for the cases of closed systems, power oil is mixed with wells' production. With the present trend toward automatic operation of the oil-producing leases, centralizing power and controls for a number of wells in one place may favor hydraulic pumping in some cases.

An intangible but important factor is the familiarity of the field personnel with the method of pumping to be selected. Hydraulic pumping has been applied now in oil-field pumping for 30 years. Its use has not been as widespread as that of sucker-rod pumping. It must be realized, therefore, that in many cases proper training of field personnel is essential if hydraulic pumping is decided upon. Manufacturers of hydraulic pumping equipment made considerable progress toward this end during the last few years. The equipment has been improved and simplified and technical services are offered to help in solution of operating problems.

Economics of both the investment and operating costs must, of course, be considered. As far as investment is concerned many users of the pumping equipment find that for medium-depth or deep pumping, three wells represent the limit of the per well investment advantage of individual beam installations, particularly if lifting of large volumes of fluid is involved. This means that, if other conditions make hydraulic pumping feasible, for a lease with three or more wells the per well investment in pumping equipment is lower for central hydraulic pumping than for individual beam installations.

Many comparative operating cost data have been accumulated over the years. But the differentials between respective costs vary so widely that no generalized comparison can be made. Best approach is to investigate the operating costs of installations operating under conditions reasonably similar to those for which the selection is to be made.

Design. Once hydraulic pumping has been decided upon, the first step of design is selection of a subsurface production unit, for the given conditions of volume, lift, and fluid gradient, from manufacturer's specifications. Usually more than one unit fulfills the requirements.

In final selection two points must be considered. (1) Data given for the pump end of the unit may be based on 100% volumetric efficiency. Proper correction must then be made based on well and produced-fluid characteristics. (2) The unit must be adaptable to the subsurface system to be used, selection of which is made on the basis of its applicability to existing well conditions, (Part 47).

Next step is determining the power-oil requirements of the system. Manufacturers' specifications furnish this information for the individual units. In calculating this requirement the following is taken into consideration:

$$V_{pf} = (V_p/E) \times (A_e/A_p) \quad (1)$$

Where:

V_{pf} = power-oil fluid required, bbl. per day.

V_p = volume to be produced, bbl. per day.

E = over-all efficiency, of the unit, expressed as a decimal.

A_e = area of engine piston, sq. in.

A_p = area of pump plunger, sq. in.

For the one-to-one ratio units the equation is, of course:

$$V_{pf} = V_p/E \quad (2)$$

The over-all efficiency of the unit includes the efficiency of both the engine and the pump. It is sometimes assumed as 0.65[1]. But it can be lower if the pump-end efficiency is expected to be low, as mentioned above.

The operating pressure required is calculated from equation:

$$P_o = H \times d \times (A_p/A_e) + F + S_p \quad (3)$$

Where:

P_o = operating pressure, psi.

H = actual lift, ft.

d = fluid gradient, psi./ft.

F = Friction losses of the system, psi.

S_p = Separator pressure, psi.

In contrast to sucker-rod-system calculations, friction has to be calculated. Frictional losses involved are those occurring in flow through, (1) power oil lines from the triplex to the individuals wells, (2) subsurface system, and (3) flow lines from the wells to the separator.

There are three approaches for finding the frictional losses: (1) by use of conventional formulas available in different engineering handbooks, (2) by use of charts prepared for this purpose by some manufacturers, or (3) by increasing the pressure calculated from Equation 3 without the friction factor by 10 to 15%.

Total volume of power oil needed determines the size of the power-oil tank (Part 45). Volume of power oil and operating pressure permit selection of the size of triplex pump needed. In selecting the pump it should be remembered that some of the pump's auxiliaries require power and that some of the operations of the system may require temporary increases in power. The size of the prime mover should equal the horsepower rating of the pump, plus 10%.

Considerations similar to those used in selecting the type of prime mover for beam installations (Part 37) apply also in deciding whether electric motor or internal-combustion engine should be used.

Reference

1. J. T. Lewis, "Selection and Analysis of Hydraulic Production Systems": Proceedings of the eighth annual West Texas oil-lifting short course, 1961, Texas Technological College.

BY W. L. NELSON, Technical Editor and Petroleum Consultant

Light-oil treating—6

Summary of process operating costs

IN THE TREATING of light oils, numerous combinations of treating are practiced. Hydrogen sulfide must be removed from the lowest-boiling materials (naphthas, solvents, gasoline, jet fuel, and kerosine) and this is usually accomplished by caustic washing (Process Costimating No. 49 and 83), although much hydrogen sulfide is removed by stabilization. Mercaptans must be removed from nearly all of the light oils and this is accomplished by the so-called sweetening processes. The doctor, copper, catalytic lead sulfide, and inhibitor sweetening processes remove mercaptans by oxidizing them into disulfides (Process Costimating No. 89). This eliminates the bad odor of mercaptans but leaves sulfur in the product which in the case of gasoline decreases the susceptibility to tetraethyl lead. In the solution types of sweetening processes (Solutizer, Unisol, Mercapsol, etc.), the mercaptans are dissolved in alkaline solutions and are then removed from the solutions by stripping with steam or air (Process Costimating No. 87). Sulfur is eliminated from the product and hence a very significant saving in TEL is accomplished by such processes.

The amount of sulfur (hydrogen sulfide, mercaptans, and free sulfur) involved in the caustic washing and sweetening treatments is usually somewhat small, and hence any really high-sulfur materials must be treated with sulfuric acid (Process Costimating No. 93) or desulfurized by catalytic processes (Process Costimating No. 73). Both catalytic desulfurization and acid treating are very expensive compared with other light-oil-treating processes but no cheaper methods have been devised for significant reductions of percentage of sulfur.

All of these operations have been discussed in earlier issues of Process Costimating as shown in the box on this page.

Finally, additives (or inhibitors) must be added or injected, TEL must be mixed with most gasoline, and the use of filtration has been found to be useful in the finishing of some materials, notably kerosines and solvents. These finishing operations are summarized on this page in Table 1 as well as price indexes of some of the finishing chemicals in Table 2.

INSTALLMENTS ON CHEMICAL TREATMENT

No. 43—Cost of Crude Oil Desalting, March 30, 1959, p. 167.
No. 49—Caustic Washing, June 1, 1959, p. 180.
No. 58—Price Indexes of Chemicals, Oct. 12, 1959, p. 186.
No. 62—Chemicals Used in Various Processes, Dec. 7, 1959, p. 143.
No. 64—Indication of Chemical Consumption, Jan. 11, 1960, p. 97.
No. 68—TEL Consumption, March 21, 1960, p. 127.
No. 70—Annual Consumption of Chemicals, April 25, 1960, p. 210.
No. 72—Chemicals Consumed in Refining, May 30, 1960, p. 109.
No. 73—Hydrodesulfurization, June 13, 1960, p. 116.
No. 74—Cost of Chemicals Outside U.S.A., June 27, 1960, p. 122.
No. 79—Gas Desulfurization, Sept. 12, 1960, p. 136.
No. 81—Gasoline Additives, Oct. 10, 1960, p. 248.
No. 83—Light-Oil Treating—1: Cost of Chemicals, Nov. 14, 1960, p. 161.
No. 85—Light-Oil Treating—2: Plant Costs, Dec. 12, 1960, p. 120.
No. 87—Light-Oil Treating—3: Labor, Maintenance, Etc., Jan. 16, 1961, p. 92.
No. 89—Light-Oil Treating—4: Oxidizing Sweetening, Feb. 20, 1961, p. 130.
No. 93—Light-Oil Treating—5: Acid Treating, May 15, 1961, p. 138.
No. 95—Light-Oil Treating—6: Summary, May 29, 1961, p. 154.

Complete cost of Light-Oil Treating

Table 3 is an attempt to summarize the types of processes used in treating light oils. Many alternatives are possible and some feed stocks require treatments that do not seem to be necessary for others. The major treat-

TABLE 1—OPERATING COSTS OF MISCELLANEOUS LIGHT-OIL-TREATING OPERATIONS, CENTS PER BARREL (1956)

		Injection of additives* or inhibitor		TEL Blending		Filtration (clay, sand or salt)	
	1956 Unit Cost	10,000 B/D	2,000 B/D	20,000 B/D	4,000 B/D	5,000 B/D	1,000 B/D
Operating labor	$3.12/hr.†	0.075	0.191	0.075	0.190	0.150	0.380
Supervision	$3.85/hr.†	0.046	0.10	0.023	0.050	0.092	0.200
Maintenance	Proc. Cost. No. 85, 87	0.002	0.006	0.018	0.040	0.007	0.012
Electrical power	0.85c/Kw.-hr.	.....	....	0.034	0.034	0.034	0.034
Direct cost without chemicals		*0.123	0.296	0.150	0.314	0.183	0.626
Chemicals							
Additives‡	Proc. Cost. No. 81	0.9-13	0.9-13	.....	.....	.....	.....
Inhibitor (sweetening)	$1.40/lb.	or 0.4-1.1	or 0.4-1.1	.....	.....	.....	.....
TEL	0.218c/ml.	.....	...	18-27	18-27	.....	.....
Clay	2.0c/lb.	.....	....	....	....	§0.4-2	§0.4-2
Salt	1.3c/lb.	.....	....	....	....	or ¶.01-.1	or ¶.01-1
Lab. testing	$3.12/hr.†	0.12	0.30	0.12	0.30	0.24	0.60
Obsolescence, etc.	10%/yr. replacement	0.013	0.04	0.12	0.27	0.33	0.06

*For one injection equipment.
†Average U. S. refinery wages including 27% for all burdens.
‡Average of all types used in gasoline is 1.9 cents per barrel.
§0.2-1 lb. clay per barrel kerosine.
¶3 to 60 lb. per 1,000 bbl. for drying.

ments have been assigned numbers as follows:

A—Hydrogen sulfide removal
- A-1 Stabilization or fractionation
- A-2 Caustic wash
- C-1 Hydrodesulfurization

B—Sweetening
- B-1 Oxidizing processes (doctor, copper, or lead sulfide)
- B-2 Inhibitor sweetening
- B-3 Regenerative (solutizer, etc.)

C—Sulfur reduction
- C-1 Hydrodesulfurization
- C-2 Acid treating
- C-3 Rerun distillation
- C-4 Sulfur dioxide extraction

D—Finishing and miscellaneous
- D-1 Additive injection
- D-2 TEL blending
- D-3 Filtration

Such a comparison as that of Table 3 is not altogether satisfactory because it fails to indicate the quality of the products such as the susceptibility of the gasoline to tetraethyl lead. Likewise it fails to account for the degree of treatment or the size of plant. With regard to the severity of treatment, if 10,000 bbl. per day of straightrun gasoline and 10,000 bbl. per day of cracked gasoline is treated by caustic washing, sweetening, desulfurization (if necessary), and the introduction of additives and TEL (but not the cost of additives or TEL), the effect of amount of sulfur in the crude oil on treating cost is somewhat as follows:

% S in crude:	Ct./bbl. Sweet	Ct./bbl. Sour
0.2 Mid-Cont.	3.4	
0.6 Mid-Cont.		3.9
0.8 Venez.	4.6	
1.0 W. Tex.		7.9
2.0	9.1	18.3
3.5	13.2	

In general, average costs were contemplated in Table 3 and normal plant sizes, that is very small plants for LPG, small plants (1,000-5,000 bbl. per day) for solvents and kerosine, and large plants (10,000-20,000 bbl. per day) for most other products. The cost of chemicals was included except the cost of TEL and additives. The effect of plant size (excluding acid treating) is somewhat as follows using a 10,000-bbl. per day plant as the basis:

B/D	Per bbl. cost
1,000	2.0
2,000	1.7
5,000	1.3
10,000	1.0
20,000	0.9

Finally, charges for operating labor tend to duplicate one another resulting in total labor costs that are slightly high for the entire combination treating operation. This may result in reductions of the treating costs of Table 3 of 0.5-1.0 cent per bbl.

Note also that the costs of obsolescence, depreciation, taxes, insurance, royalties, interest (or dividends), and laboratory control are not included and note especially that treating losses are not charged as an expense. These costs, most generally, are about equal to the total costs shown in Table 3.

TABLE 2—PRICES AND INDEXES OF CHEMICALS

	Inorganic Chemicals	Organic Chemicals	TEL Fluid	Fullers Earth	Rock Salt	Operating Nelson‡ Costs (Units)
1956 Prices*	....	....	0.218	2	1.3	....
1934	†60.3	†60.3	150	....	....	32.2
1940	†59.2	†59.2	108	....	....	37.2
1941	†60.6	†60.6	95	....	....	39.0
1948	73.7	87.5	87	....	103	76.8
1952	88.0	99.0	105	....	77	82.2
1953	92.2	100.0	105	152	83	87.3
1954	96.0	97.3	103	152	98	88.4
1955	97.2	97.3	99	125	96	91.5
1956	100.0	100.0	100	100	100	100.0
1957	101.8	102.6	101	100	104	107.1
1958	103.1	101.1	100	100	108	105.8
1959	104.0	101.2	101	100	108	106.0
1960	104.7	101.0	98	100	108	108.1

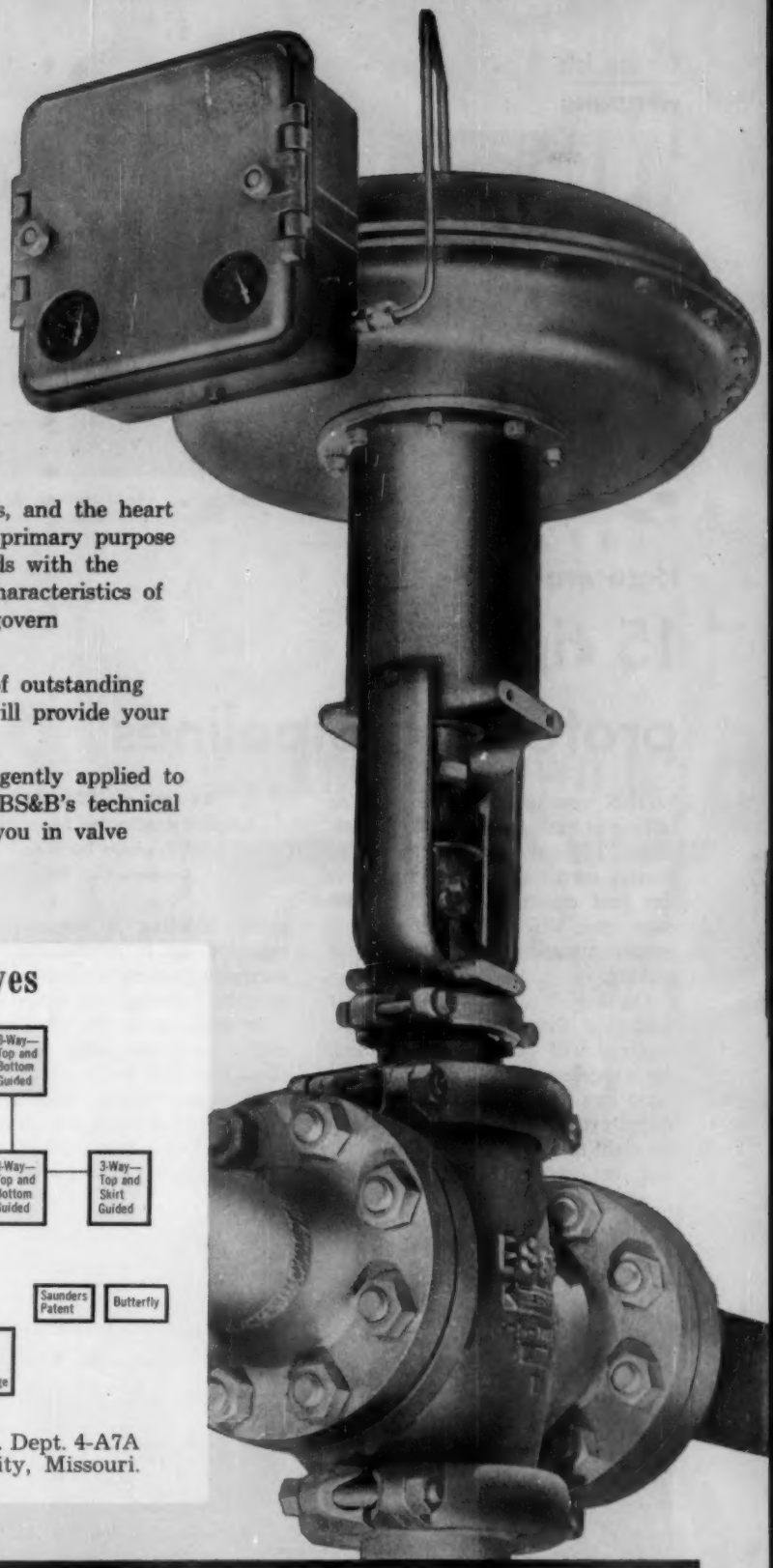
*Cents per pound, delivered in somewhat small lots, except TEL which is cents per milliliter.
†Industrial chemicals rather than organic chemicals.
‡Applies to process units. There is also an operating index for refineries.

TABLE 3—SUMMARY OF COMPLETE LIGHT-OIL TREATING OPERATIONS, APPROXIMATE CENTS PER BARREL (1956).* OBSOLESCENCE, DEPRECIATION, TAXES, INSURANCE, INTEREST, AND LABORATORY CONTROL NOT INCLUDED

Treating operation—	Refer to Process Costimating number	Butane or propane	S.R. gasoline Lo S	S.R. gasoline Hi S	Solvents§ Lo S	Solvents§ Hi S	Cracked gasoline Lo S	Cracked gasoline Hi S	Kerosine Lo S	Kerosine Hi S	Distillates Lo S	Distillates Hi S	Cycle stocks, Hi S
A-1 Stabilization	54	(†)	(†)	(†)	....	....	(†)	(†)	....	....	....	....	....
A-2 Caustic wash	49, 83, 85	1.75	0.75	1.25	0.75	1.25	1.00	1.90	....	....	0.70	....	....
B-1 Oxidizing sweetening	83, 85, 87, 89	1.40	0.70	0.85	1.80	1.80	....	....	1.20	1.40	‡0.90	‡1.20	....
B-2 Inhibitor sweetening	85, 87, 95	....	....	....	....	....	0.89	‡1.00	....	....	....	....	....
B-3 Regenerative sweetening	83, 85, 87	....	....	....	....	....	....	3.40	....	....	....	....	....
C-1 Hydrodesulfurization	73	....	....	7.00	....	10.00	....	....	....	11.00	....	13.00	16.00
C-2 Acid treating	83, 85, 87, 93	....	....	....	....	‡4.00	....	‡7.20	....	....	....	....	....
C-3 Rerun distillation	32, 93	....	....	....	....	....	....	‡14.00	....	....	....	....	....
C-4 SO_2 extraction	....	....	....	....	....	(‡)	....	....	....	(‡)	....	(‡)	....
D-1 Additive injection¶	81, 85, 87, 95	....	....	....	....	....	‖0.30	‖0.30	....	....	0.15	0.15	....
D-2 TEL blending¶	68, 85, 87, 95	....	0.20	0.20	....	....	0.15	0.15	....	....	....	....	....
D-3 Filtration	85, 87, 95	....	....	....	‡0.50	‡0.50	....	....	‡0.35	‡0.35	0.18	0.18	....
D-4 Drying	....	(†)	....	....	....	....	....	....	....	....	....	....	....
Total direct costs,* ct./bbl.		3.15	1.65	9.30	2.55	13.05	2.34	5.75	1.20	12.40	1.03	13.33	16.00
Additives¶	....	....	....	....	....	....	2.40	2.40	....	....	0.50	0.20	....
TEL¶	....	....	25	25	....	....	23.00	23.00	....	....	....	....	....

*The most widely used operations are included in the total. Average costs (and average plant sizes) used throughout for simplification and note that small plants (LPG, solvents, kerosine) increase the cost of operation. †Accomplishes purposes of treating but not charged to treating costs. ‡Alternative processes which may be used but which may not be needed. Not included in totals. §Including jet and rocket fuels. Aromatic solvents are often acid treated. ¶Chemical cost should be added as a separate item to the sum of the other costs. ‖Using three separate equipments for injecting chemicals.

When Your Process Demands Excellence...

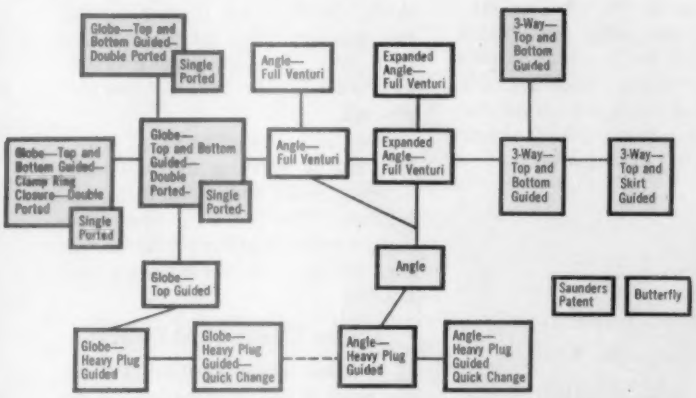


A process is only as good as its controls, and the heart of a control system is the valving. The primary purpose of a valve is to control the flow of fluids with the demands of a process determining the characteristics of the valve. Your process, will therefore, govern valve selection.

BS&B's Super 70 valves with a record of outstanding performance under exacting conditions will provide your process with maximum efficiency.

A valve will work best only when intelligently applied to the operating conditions of the process. BS&B's technical service group is well qualified to assist you in valve selection and application.

The Super 70 Family of Valves



For the complete Super 70 story, write . . . Dept. 4-A7A
BS&B 7500 East 12th Street, Kansas City, Missouri.

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CASUAL HOLIDAY DETECTING can lead to missed areas where coating is nonuniform or where spots are bare. If enamel is still hot, jeep voltage should be increased to insure penetration.

Here are

15 tips on protecting pipelines

BY LEO J. CROWDER
Koppers Application Supervisor,
Tar Products Division,
Koppers Co., Inc.

WHEN you talk pipelines, you're talking of multimillion dollar investments. It's only sound business to protect such costly equipment with the best materials available. But even these will not do their job if proper attention to application is lacking.

On-the-job supervision is the best insurance that protective pipeline coatings will be correctly applied. An experienced application supervisor can check a job in various stages even while he's driving along the right-of-way. Beginning at either end, he can spot areas where the primer coating is uneven, where touching up is needed, or where thorough cleaning is required before priming, coating, and wrapping.

In addition to the obvious mistakes, there are many less-distant clues that call for a closer inspection. Any pipeline inspector can give dozens of examples—some due to lack of knowledge, others simply overlooked, but all important.

IF ROLLS ARE MISALIGNED, paper will "tuck." The man on the left is watching the paper roll to make sure that it doesn't tuck. Proper head position will avoid this result.

The following check list covers the most commonly neglected areas of importance on a pipeline job.

Before Cleaning and Priming

1. Don't neglect general housekeeping. If tools and materials lie around in disorder, if application equipment appears poorly maintained, and if the crew exhibits a sloppy appearance and low proficiency, chances are the application job will not be satisfactory. Good housekeeping practices should be followed throughout.

2. Don't permit uncoated pipe to become "soiled." When the uncoated welded pipe is resting on skids, check to see if mud or clay has dried in cakes on the exterior. If it has, the pipe was probably allowed to lie on wet, muddy ground.

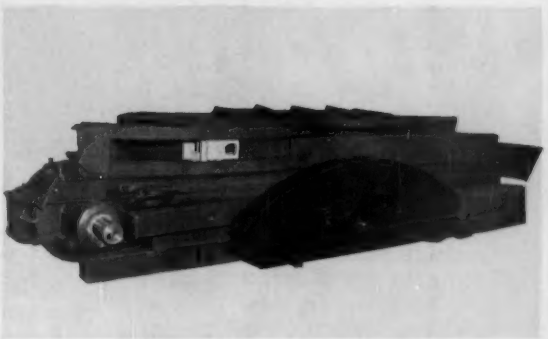
This increases chances of corrosion before priming and will make cleaning more time consuming and difficult. The skids themselves should be checked for proper crotching, both in level and in rough, hilly country.

During Cleaning and Priming

3. Don't ignore position of cleaning head. If the cleaning head is not correctly positioned, the priming head will be misaligned, too. This results in a haphazard cleaning job and an uneven application of primer.

One way to "look" for a misalignment is to listen to the sound of the scrapers and wire brushes against the pipe. If the pitch of the sound is uneven, the cleaning head is probably aligned to one side.

To counteract this, center the



Bethlehem's new Series "60"...

...knocks down to minimum export cubage

New truss design for maximum rigidity and strength . . . and maximum torque per pound of structure.

Improved gear reducer with maximum accuracy of gear-bearing-shaft alignment — immediate lubrication.

New engineering throughout for maximum operating economy — new ease of servicing — pre-lubricated bearings.

For more details on this all-new pumping unit, write for Booklet 1669, or call our nearest representative.

The truss structure of the Series "60" knocks down easily into convenient single-beam sections for unusually compact packaging . . . and low shipping costs.

TYPICAL EXPORT CUBAGES*

A.P.I. PUMP	SERIES 60**	SERIES 50
80-133-54	325 cu ft	478 cu ft
114-169-64	370 cu ft	545 cu ft
228-200-74	531 cu ft	780 cu ft

*Figures include ground-level, internal-combustion engine power assemblies.
**For multiple packaging, reduce cubage 17½ per cent.

For more export information, write to our Export Department at the address below.

BETHLEHEM STEEL COMPANY, SUPPLY DIVISION
Export Dept. and General Offices: 21 East Second St., Tulsa, Okla.
Canadian Distributor: Bethlehem Steel Company of Canada, Ltd., Calgary, Alberta, Canada

BETHLEHEM STEEL

BETHLEHEM STEEL SUPPLY DIVISION

PRIMING HEAD will be misaligned if cleaning head is not correctly positioned.

cleaning head about ⅛ to ¼ in. above the pipe center line. This will give even cleaning, and the priming rugs will not "miss" the bottom of the pipe.

4. Don't forget to measure priming head. This can result in a heavy thickness of primer on one side of the pipe, a lighter coating on the other. To avoid this, a measurement should be made when the machine is first shut down.

5. Don't overlook postpriming check. Neglecting to inspect the pipe after priming will often result in bare spots where the enamel will not adhere to the pipe surface. The "barber pole" effect should be very minor in a good application job. If it's pronounced, the rugs might be too tight, too loose, or riding improperly. All weldments and the bottom of the pipe should be carefully checked for bare spots and nonuniform primer thickness.

Before Coating and Wrapping

6. Don't neglect a little dust. If dust settles on the primed pipe, it will cause loss of adhesion between primer and coating. One way to cut down on dust buildup is to minimize traffic along the pipeline right-of-way. Since excess traffic is also a safety hazard, this should be a continuing check point during the entire operation.

7. Don't forget careful touching up. Neglect could result in a poor bond, since the hot enamel will not adhere properly to bare metal. One man, armed with a scraper and primer, can touch up the pipe where it has laid on the skids.

During Coating and Wrapping

8. Check pot temperature. Since ambient temperatures fluctuate, the pot temperature will vary slightly, and the enamel may become difficult to work. This is especially a problem in cold weather, when the heat loss due to transfer from pot to coating machine is higher.

9. Don't ignore uniformity of coating. This may result in a loss of time later, when weak spots are detected. To check for an even coating of enamel, look for plugged spray holes or improperly fitting drag shoes on the coating head.

10. Don't forget paper-head position. If the rolls become misaligned, the paper will "tuck." If this happens, the paper head is probably too far to one side of the pipe or the paper arms may not be properly set. The head should be positioned slightly above the pipe centerline, but as close to it is possible.

11. Give glass fiber special attention. This could also result in glass-fiber tucks and poor saturation on the pipe bottom. Since two extra rolls are on the wrapping head when glass fiber is used, misalignment of the head is doubly undesirable. Special attention to alignment will insure proper saturation of coating around pipe circumference.

After Coating and Wrapping

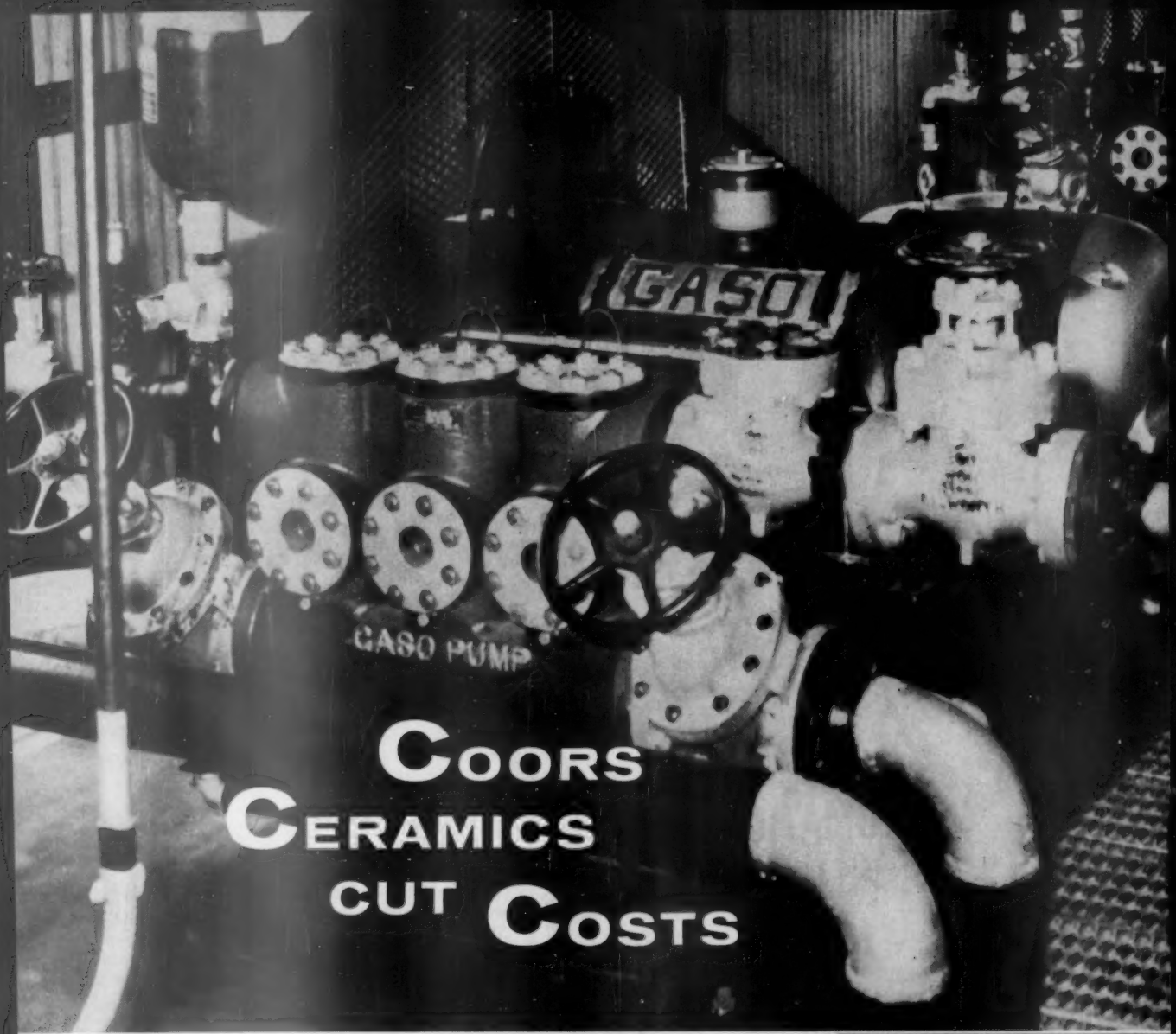
12. Don't neglect pit gages. This could save time, but no one will know the actual coating thickness. It is economical to use the gage at skid points, since these must be retouched anyway. All check points should be marked with chalk or crayon so they can easily be located for touching up.

13. Adhesion test isn't just a nuisance. If the primer-enamel bond isn't satisfactory, deterioration will occur and corrosion will result. A few strips should be cut at intervals along the coated and wrapped pipe to test for proper adhesion.

14. Holiday detecting isn't all the same. This could result in missed areas where coating is nonuniform or bare spots are located. If the enamel is still hot, jeep voltage should be increased for satisfactory electrical penetration to the pipe surface.

15. Don't lay pipe immediately. Unless the ditch has been checked beforehand, this could result in rupturing of the protective coating. The ditch should be thoroughly checked for clay "knots" or rocks that might press against the coating and rupture it, presenting a breach for corrosion.

POSITION of the coating head before wrapping is checked. A holiday detector is visible around the wrapped pipe just behind the wrapping head.

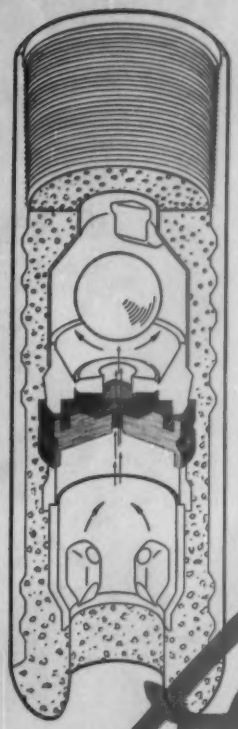


COORS CERAMICS CUT COSTS

You, Too, Can Cut Pump Maintenance Costs By Using Coors Ceramic Plungers. Coors Ceramic Plungers, 2-¾" diameter, were installed in this GASO Figure 3466 Horizontal Triple Plunger Pump when it was placed in water flooding service June 1, 1957, operating at 225 RPM against 900 PSI. In 1960, after 1,504,320 barrels of salt water had been discharged, it was found that only $73.89 had been spent on maintenance. This expenditure was for repacking the plungers three times—after 7-½, 15 and 27-½ months' service. The original Coors Ceramic Plungers are still in regular service in this pump. All leading builders of plunger pumps have Coors Ceramic Plungers available—normally from stock. Please ask the builder of your pump for Coors Ceramic Plungers to help you cut pump maintenance costs.

GASO PLUNGER
OF COORS CERAMIC

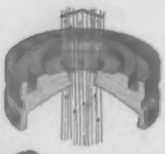
Coors
ALUMINA CERAMICS
Coors Porcelain Company
600 NINTH STREET • GOLDEN, COLORADO



HERE'S HOW the FLEXIFLOW Variable Valve automatically fills casing from the bottom...

A When casing is lowered, pressure from below causes the hole in the reinforced synthetic rubber disc to open wider, and fluid enters the casing, thus preventing build-up of pressure surges.

B As the rate of lowering the casing is slowed down (to set the joint in the slips) pressure from below decreases; the hole in the Variable Valve diaphragm contracts; fluid volume entering the casing is reduced and overfill is avoided.



ECONOMICAL

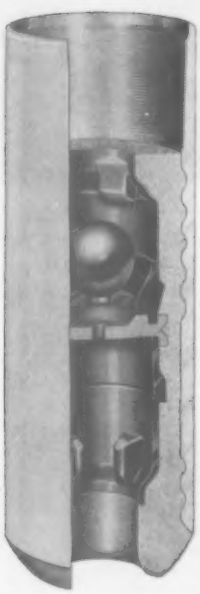
flexiflow

AUTOMATIC FILL-UP MEANS

NO SURFACE FILLING

CASING ON BOTTOM SAFER AND FASTER

PROTECTION OF PRODUCTIVITY



When pressure builds up as casing is lowered in the well, the Variable Valve in Baker FLEXIFLOW Shoes and Collars automatically opens wider and prevents pressure surges by permitting a large volume of fluid to enter the casing. As the rate of lowering is slowed down, pressure from below is lessened and the Variable Valve contracts to restrict fluid entry and prevent overfill. This automatic opening and closing action balances the *rate of fill* with the *rate of lowering* and prevents build-up of dangerous pressure surges.

Casing running time can be greatly reduced because Baker FLEXIFLOW Shoes and Collars save the time otherwise wasted in surface filling; and automatic "fill" permits the casing to be run faster without danger of damaging the formation by high-pressure surges. A back-pressure valve, for floating or cementing, is actuated by pressuring the casing.

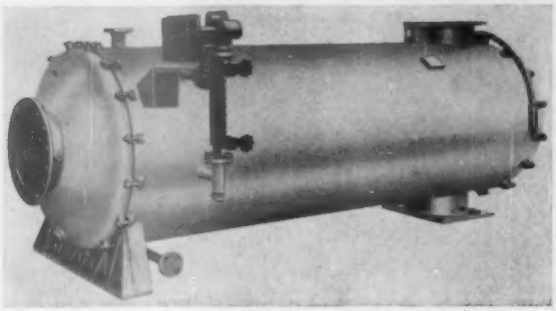
Ask any Baker representative how FLEXIFLOW Shoes and Collars (Regular or Circulating Type), used in combination with Baker CASING CENTRALIZERS and Baker WALL SCRATCHERS, bring you the safety and savings of Baker "Protective" Cementing.

BAKER OIL TOOLS, INC.
HOUSTON • LOS ANGELES • NEW YORK

For MORE than a good cement job, use Baker *FLEXIFLOW* Shoes and Collars in combination with Baker Casing Centralizers and Baker Wall Scratchers. *Available through your supply store.*

BAKER FLEXIFLOW
SHOES AND COLLARS

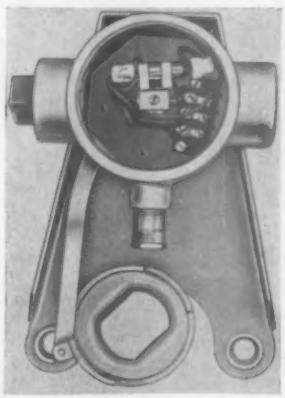
What's NEW . . . in equipment



Heat from engine-cooling system can be transferred to fluids

AN EXHAUST heat exchanger is now available in stock sizes which can be used to produce steam or heat water and process fluids in conjunction with vapor-phase cooling systems on internal combustion engines. Available for vertical or horizontal mounting, the heat exchangers are designed to meet the requirements of any type of engine plant.

The exchangers can be obtained with or without silencing elements to meet requirements. Silencing may be an integral part of the exchanger or separate. Source: **Engineering Controls, Inc.,** 611 East Marceau, St. Louis 11, Mo., U.S.A.



Explosionproof valve switch for electric-tank switching

A new pipeline valve switch is now on the market which is an explosionproof switch assembly that mounts on Nordstrom Figs. 142 and 143, 3, 4, and 6-in. valves. It provides switch action for remote indication of the position of the valve stem.

The Type 200 pipeline valve switch is designed for use in automatic tank batteries in conjunction with electric tank switchers. It is a mercury type rated at 4 amp., and 115 volts, or 2 amp. and 230 volts. It is a single-pole, double-throw type. Source: **Fisher Governor Co.,** Marshalltown, Iowa, U.S.A.

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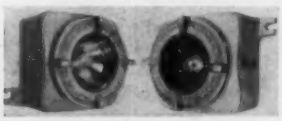

Illegal plant entry detected with new infra-red system

A new instrumentation system, called Tattleguard, provides an invisible electronic curtain of security for plants and other property. The illegal-entry-detection system scans up to 350 ft. and operates day or night, indoors or outdoors.

The system consists of two basic units: a transmitter and a receiver. Between these, an invisible infra-red beam passes. When persons, animals, or vehicles interrupt this beam, it actuates a relay in the receiver. This relay can be used to operate other alarm equipment.

The system is explosionproof and functions in temperatures from −40° to 140° F. at 100% humidity. Completely transistorized, it operates on 12 volt d.c. power. Source: **Alnor Instrument Co.,** 420 N. LaSalle, Chicago 10, Ill., U.S.A.

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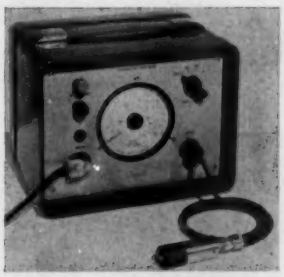


Transistorized tachometer

Three full-scale speed ranges of 0-to-3,000, 0-to-10,000, and 0-to-30,000 r.p.m. are provided by a new tachometer which can be obtained with a photoelectric pickup for use with visual markings or a magnetic pickup. The speed of all shaft types and sizes can be determined to an accuracy of ±1%, without physical contact with the shaft.

The Model M1149 instrument can be operated from a 110 or 220-volt power source or from a 12-volt battery. Frequency measurements are shown directly on the meter of the tachometer. Source: **Southern Instruments, Ltd.,** Frimley Rd., Surrey, England.

Need more facts on the items described on these pages?

The manufacturers will gladly supply them. They're shown in bold type, with their addresses. For convenience, send this coupon to the manufacturer.

ITEM _____

_____

July 17, 1961

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____

Sight-flow indicator easily positioned for best view

Rotable split-ring flanges on the flanged models of a new line of sight-flow indicators let you precisely position them in the pipeline for the best viewing angle. The indicators are designed to meet the needs of chemical processing and have no blind threads. They have ratings to 500 psi. and temperature ratings to 300° F. Made in both flanged and screwed models, they come in cast iron, steel, or stainless steel. Source: **Brooks Instrument Co., Inc.**, Hatfield, Pa., U.S.A.

API Cut Thread
Most susceptible to fatigue is thread root area, where notch effect exists.
Jones Rolled Thread
Mirror-like surface aids application of make-up torque to pre-stress joint.

...another Jones First

JONES

Rolled-Thread Undercut Pin

Greater Strength–Easier Make-Up

Rolled threads, made by cold working or displacing the metal into the thread form, are stronger at the very point where most cut-thread pin failures originate. Steel fibers and grain are rearranged to follow the thread contour, providing a dense structure at the critical thread root . . . added strength where it is needed most. Additional fatigue resistance is obtained by undercutting the pin shank, thereby eliminating the run-out thread and improving the elasticity of the joint. The superior finish and gauge tolerances attained in Jones rolled-thread sucker rod pins reduce friction and make possible greater prestressing of the joint with equal torque.

Ask your Jones representative for complete information on this new Jones development.

THE S. M. JONES COMPANY

Division of Buffalo Eclipse Corporation
General Office and Factory: TOLEDO, OHIO
Sales Office: Enterprise Building, TULSA, OKLAHOMA
Export Department: The S. M. Jones Company

140

JONES

SUCKER RODS

Solid-state remote alarm

Any number of data points are sampled and encoded by a new remote alarm monitor just brought out. The instrument, tradenamed the Alerta Model 901, keys a single channel of any transmission medium—microwave, UHF, VHF, or telephone line. At the receiver, the signal is decoded and displayed. Operation is continuous.

Suited for rack or desk mounting, the monitor features plug-in type of construction and is contained in a package measuring 3½ by 5 3/16 by 6 15/16 in. It can be operated either on 115-volt a.c. or 12-volt d.c. Source: **Compudyne Corp.**, Hatboro, Pa., U.S.A.

•

Defoamers act fast

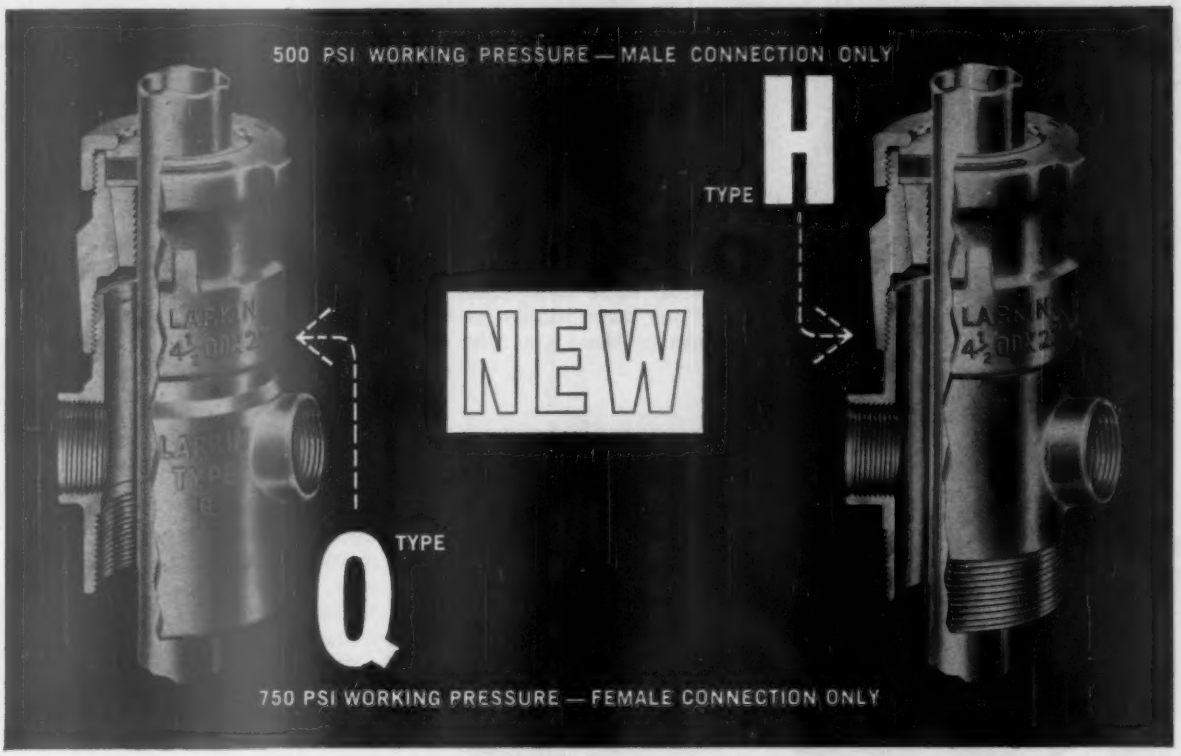
Troublesome foam in chemical processes can be removed quickly with a new series of defoaming agents now available, the maker says. Designated Nos. 1840, 1841, and 1842, the products are designed respectively for use in high, normal, and low-temperature applications.

The maker says they can be used under any temperature situation normally encountered in chemical processes. Viscosity is reportedly uniform over a considerable temperature range. Dispersion throughout the system is immediate after feeding. Slug dosages of 10 to 30 p.p.m. are said to extinguish and suppress foam in most applications for more than 1 hour. Source: **Ionac Chemical Co.**, Birmingham, N. J., U.S.A.

•

Alarm systems monitor mud levels, warn driller

Three basic systems of a new electronic mud-level alarm system have been developed—a low-mud-level alarm system to detcet lost circulation, a high-mud-level alarm system to detect excessive returns, and a combined low and high-level



Two new Larkin Tubing Heads

Two new answers to today's demand for economy

Larkin Type Q and Type H Heads bring to the low pressure field a completely new line of economical, high quality, slip-suspension tubing heads in a really complete range of sizes.

They are available in sizes from 2" Reg. or EUE tubing through 7" OD casing. Their three segment hinged slips will safely suspend up to 5000 feet of ¾" through 2½" EUE tubing or up to 3000 feet of 3" Reg. through 4" EUE tubing.

They are full opening in **all sizes.**

All cast parts are ductile iron pressure castings with more than adequate wall sections to provide generous safety factors. All steel parts are made of J-55 casing or of forgings with equivalent properties.

The Hycar Packing Ring is made of a high quality oil and gas resistant compound which has proved successful for many years.

All threads are current API threads which will conveniently accommodate valves or other control equipment.

Accessories which contribute to the versatility of these two new heads are the Spider Base and the Pipe Wiper which are illustrated. The Pipe Wiper will also hold pressures within the ratings of these heads. The Spider Base serves as a thread protector and a base for the tubing spider during workovers.

Type Q and Type H Tubing Heads are truly economical. Write us, or call your local Larkin representative for further particulars.

LARKIN PACKER COMPANY

DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

LARKIN

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DARCOVA
now offers...
• MORE STRENGTH
• MORE LIFE
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with 100% NYLON COMPOSITION!

Darcova Valve Cup
Darcova Seating Ring
Darcova Seating Cup
Darcova 45° Bevel Cup

and, *only* in DARCOVA can you get this time-saving, money-saving advantage! Available in the full range of sizes and Darcova textures for varying well conditions.

Send for Bulletin No. 5709
and specify DARCOVA at your supply store.
There *is* no substitute!

DARLING VALVE & MANUFACTURING COMPANY
DARCOVA ®
WILLIAMSPORT 1, PA.
THE ORIGINAL COMPOSITION CUP

alarm system to detect both lost circulation and excessive returns. The Flolight alarm systems can be used as control units for controlling other fluids or semifluids too.

Each system comes completely wired and ready to install. Warning signals on the control unit consist of a warning horn and a light—red for low mud level; green for a high mud level. After each alarm, the control unit automatically resets itself. Source: **Hutchison Mfg. Co.,** 6609 U St., Houston 11, Tex., U.S.A.

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Glycol loss causes shutdown

A new shutdown device for use on a line of glycol pumps functions when loss of glycol occurs in an accumulator or contactor. A velocity-check device, it permits flow only as long as glycol is being discharged with gas from the wet-glycol discharge of the pump.

At high pumping rates and high pressures, 5 to 10 strokes of the pump will actuate shutdown after glycol loss. At low pressures and low pumping rates, the reaction time may be 1 or 2 minutes. Source: **Kimray, Inc.,** 52 NW 42, Oklahoma City, Okla., U.S.A.

•

Chemical feeder for oil field designed to resist corrosion

All wetted parts of the new P-1 chemical pump are of stainless steel to resist corrosion. These parts include the cylinder, plunger, packing glands, check valves, and seats.

Components of the unit include a ⅓-hp. proportioning pump, mixer assembly with a ¼-hp. motor, 55-gal. polyethylene tank with steel supporting frame, and such assessories as suction, drain, and pressure-relief valves, suction piping, and dissolving basket. The reciprocating pump delivers 0 to 5.9 gal. per hour at a maximum operating pressure of 860 psig. Source: **Hagan Chemicals & Controls, Inc.,** Hagen Center, Pittsburgh 30, Pa., U.S.A.

•

Oil slicks dispersed quickly

At offshore rigs and production platforms, oil slicks can be dispersed quickly with a new chemical that has been developed. The product, ICP-12, disperses the oil slicks by chemical action. It was developed to combat the oil slick problem in bays, lakes, harbors, canals, and streams, as well as at offshore installations.

It can be used as a spray after a slick appears or injected at the source. The maker says it also serves as an excellent oil-fire extinguisher. It disintegrates oil slicks and leaves nothing to burn. Large slicks covering a square mile or more can be sprayed with a fire hose or by air-

S. E. HUEY & CO.
ENGINEERS & SURVEYORS
BERNHARDT BLDG.
MONROE, LA.
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PIPE LINE SURVEYS

SWECO Gas Sweetening Vessels
For H_2S concentrations under 50 grains per CCF. Ideal for well site applications. No power or water required, no pumps, no liquids. Trouble free iron sponge method. Maintenance is required only a few times per year.
SWECO
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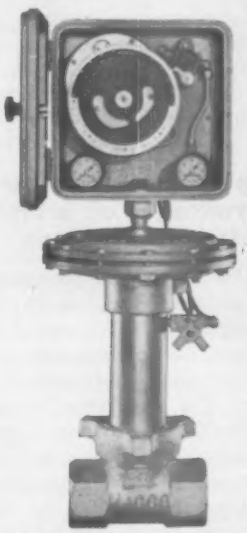
Prudential Bldg. Houston 25, Texas
Phones JA 2-5444 OR 4-8484

MACCO

DIAPHRAGM MOTOR VALVES

Both the Type "DC" and Type "S" Motor Valves have a 3,000 psi working pressure with 2" screwed connections. The diaphragm assembly, valve body, and inner valve are interchangeable. For easy field replacement the entire inner valve assembly may be removed and replaced as a unit by loosening the wing nut, without removing the valve body from the flow line and using no special tools or wrenches. The seat trims are constructed of stainless steel for most applications, or stellite for abrasive or high pressure drop conditions. Either valve can be changed in the field from reverse acting to direct acting by changing the insert type seat trim. All valves are cadmium plated throughout.

For further information, write for Motor Valve Brochure No. 8-02.



Type "DC" Motor Valve and Type "A" Time Cycle Controller

TYPE "A" TIME CYCLE PILOT

Available with 720-clip or 48-pin timing wheel, this pilot is used to automatically open or close a valve or valves on a preset schedule. Clocks are mechanical wind, gas or electric operated. A type "TPC" tubing Pressure Cutoff Pilot is an optional accessory.

For further information, write for Pilot Control Brochure No. 16-01.

MACCO equipment is also available in sterling areas from Williams & James (Oil Tools) Ltd., Gloucester, England

MACCO
OIL TOOL COMPANY, INC.
1521 Prince, P. O. Box 7288, Houston 8, Tex.
Phone UN 1-1253

plane. The product is said to be nontoxic, harmless to personnel and equipment, and noncorrosive, as well as noninjurious to fish and other salt or fresh-water life. Source: **Conco Chemical Co.,** P. O. Box 63, Dallas, Tex., U.S.A.

●

Trencher flush-digging attachment

Where clean ditches are not critical, a new flush-digging attachment for the T-66 trencher lets you crowd a 4 to 12-in. trench flush against a building, loading dock, or retaining wall. A special boom-mounting bracket sets the digging-chain assembly to the extreme left of the shaft. The auger is removed, permitting a vertical dirt shield to deflect spoil to the right of the trench. Source: **Davis Mfg. Inc.,** 1500 S. McLean Blvd., Wichita, Kans., U.S.A.

●

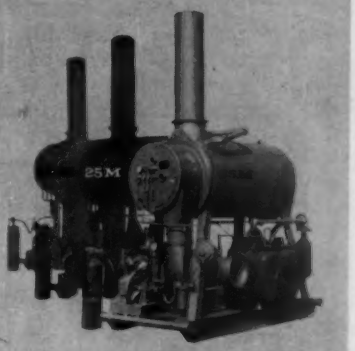
New pumps easy to get into

An axially split case on two new double-volute, single-stage centrifugal pumps now on the market makes them readily accessible. Neither suction nor discharge piping need be removed. Bearings, packings, seals, and the impeller can all be easily reached.

The Type DS pump, a water-cooled type, comes in 22 sizes with capacities to 13,000 g.p.m. with a 375-ft. differential head, and operates to 350° F. The Type DL pump, an air-cooled type, comes in 13 sizes with capacities to 6,000 g.p.m. with a 375-ft. differential head, and operates to 250° F. Source: **Pacific Pumps, Inc.,** P. O. Box 151, Huntington Park, Calif., U.S.A.

3 sizes Texheater

3 WAYS BIG
6 WAYS BEST



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6. TEXHEATERS are available in three sizes from 1,000,000 BTU/HR. to 3,500,000 BTU/HR. output.

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What's NEW

... in literature

Working handbook on pipeline fittings

This newly released publication contains complete descriptions of basic types of fittings: (1) welding elbows, branch connections, and other fittings; (2) special fittings; (3) flanges; and (4) fabricated piping. Bulletin 61-A offers information on manufacturing processes, fitting dimensions, materials available, and allowable working pressures. Source: **Midwest Piping Div., Crane Co.,** 1450 S. Second St., St. Louis 4, Mo., U.S.A.

Filters for condensate purity

The clarite filtration equipment, outlined in this free eight-page literature piece, has an application in the removal of trace quantities of oil from condensate. The publication cites advantages of the filter element and includes a line drawing showing construction details. Also given is a drawing of a typical duplex filtration system, installation notes, and applications. Source: **Croll-Reynolds Engineering Co., Inc.,** 1122 Main St., Stamford, Conn., U.S.A.

Data on corrosion resistance, thermal expansion of 32 glasses

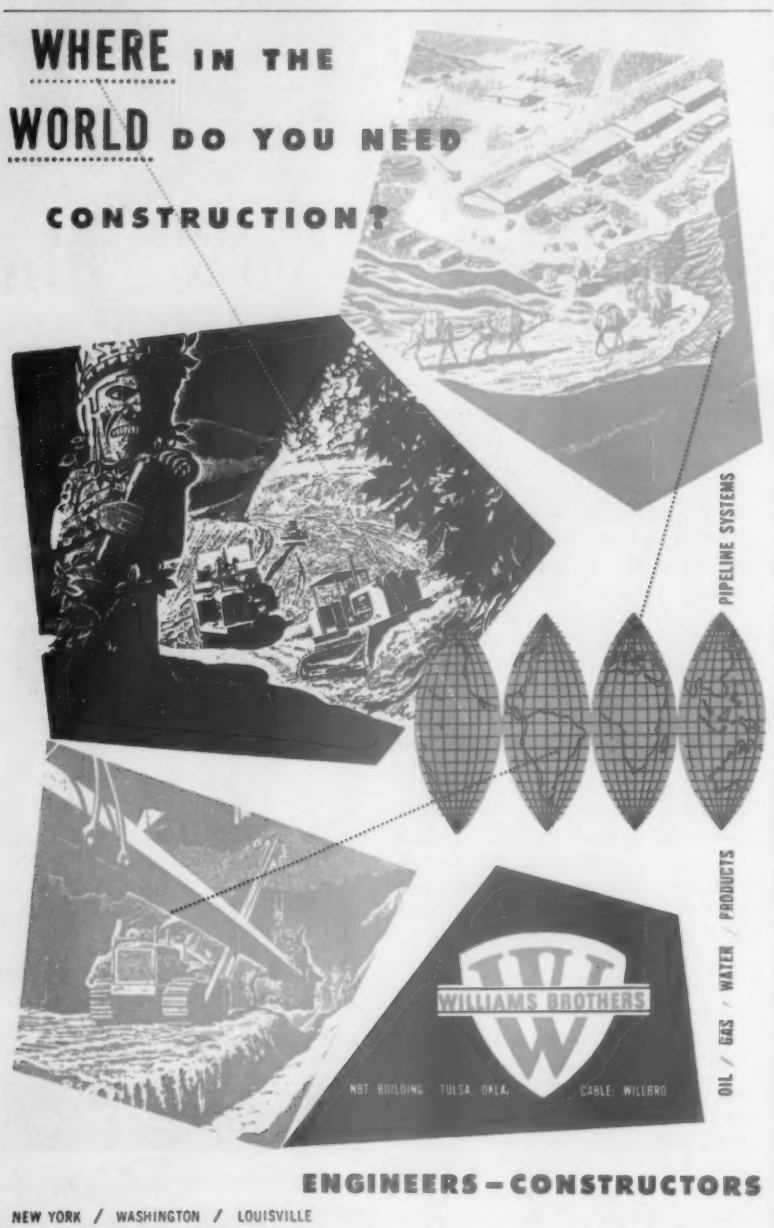
This newly revised brochure, entitled "Properties of Selected Commercial Glasses," gives the average expansion coefficient from room temperature to the setting point of 32 glasses for use in sealing applications. A numerical code system shows the resistance of each glass to weather, water, and acid. The 20-page literature (Bulletin B-83) contains information on evaluating the hardness of glass. It includes sections on mechanical, electrical and optical properties; thermal stress; heat transmission and viscosity of the glasses. Source: **Corning Glass Works,** 1946 Crystal St., Corning, N. Y., U.S.A.

Types, sizes, features, advantages of urethane seals and packings

This new catalog describes physical characteristics of Disogrin—a urethane elastomer—and shows how the material solves sealing problems in hydraulic and pneumatic equipment. The eight-page literature describes Disogrin's specially designed chamfered sealing lip and cites advantages offered by this design. Included is information on manufacturing tolerances that can be allowed with these seals, along with the types of moving-part surface finishes that can be used. Installation requirements and procedures are also described. Source: **Disogrin Industries,** 510 S. Fulton Ave., Mount Vernon, N. Y., U.S.A.

Inexpensive gas chromatograph

How to obtain speedly, reliable solutions to routine gas and volatile-liquid analysis problems with a chromatograph which sells for only $250, is explained in a new four-page bulletin on the Chronofrac, Model VP-1. By using a series of actual chromatograms, four-page Bulletin 619 defines construction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details, explains the broad usage to which the instrument can be applied, and indicates the degree of reliability and savings to be expected. Source: **Precision Scientific Co.**, 3737 W. Cortland St., Chicago 47, Ill., U.S.A.

Calculating pressure drop through lubricated plug valves

By supplying accurate pressure-drop data on existing valves, systems designers may now, through the use of this 12-page bulletin, select the most efficient and economical valve for their particular piping needs, according to the literature. It lists 85 lubricated-plug-valve figure numbers from which you may select data and calculate pressure drop with either K-values or the Equivalent Feet method. Source: **Walworth Co.**, 750 Third Ave., New York 17, N. Y., U.S.A.

Management guide to productivity

This 36-page guide is designed to expose unwarranted handling expense and to provide cost-reduction opportunities through corrective materials-handling measures. The volume contains seven efficiency - cost ratios, each of which permits you to calculate your own plant's performance in an area of materials-handling operation. Average and minimum acceptable standards are set for each ratio measure. Work sheets are provided for calculations where necessary. The guide also contains a simplified check list that permits a quick survey of unexposed plant areas where savings can be achieved. Source: **Yale Materials Handling Div., Yale & Town Mfg. Co.**, 11000 Roosevelt Blvd., Philadelphia 15, Pa., U.S.A.

Pressure and vacuum gages

Catalog C70-1a (32 pages) describes instruments for measuring, indicating, recording, and controlling pressures and vacuums involved in industrial processes. Specifications and data on instrument types and control systems are presented in detail. Source: **Industrial Div., Minneapolis - Honeywell Regulator Co.**, Wayne and Windrim Aves., Philadelphia 44, Pa., U.S.A.

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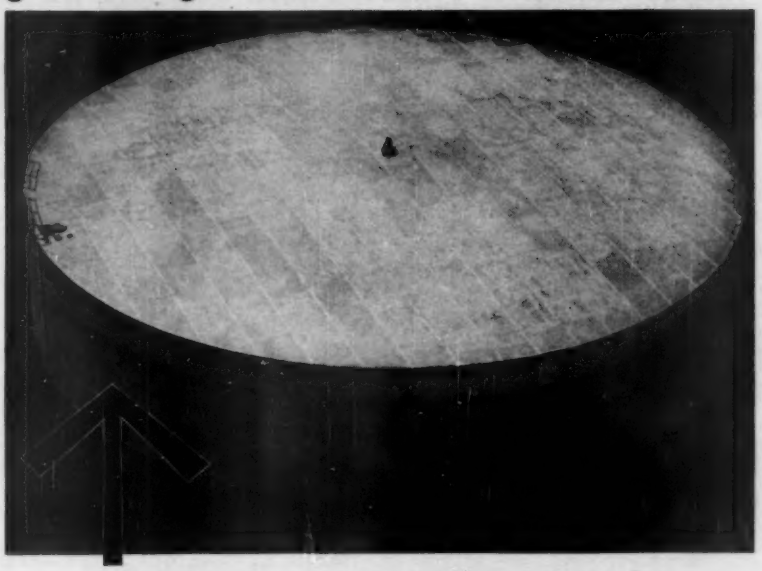

ensures uninterrupted storage of 83% ammonium nitrate at 180°F for Armour Agricultural Chemical Co.

Here you see the world's largest all-aluminum storage tank. Field-erected by Chicago Bridge & Iron Co. at the Selma, Mo., plant of Armour Agricultural Chemical Co., it holds ammonium nitrate at 180°F with minimum down time recorded since 1955. The reason for this is the unmatched ability of aluminum to resist the corrosive attack of the stored solution — and the surrounding atmosphere, as well. 26 ft high and 128 ft in diameter, the tank represents one more good design made still better by the matchless qualities of aluminum. Mail the coupon and discover how you can improve your own good designs with ALCOA® Aluminum.

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- ☐ 50-19415 Welding Alcoa Aluminum
- ☐ 02-19051 Alcoa Aluminum Handbook
- ☐ 42-20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

▶▶▶ Equipment Men Notes

John H. Rascoe to manage store ... at Pearsall, Tex. for National Supply Division of Armco Steel Corp. He succeeds J. H. Horny, who has been named sales representative for the used equipment yard at Alice, Tex. Rascoe started with National Supply's Corpus Christi store in 1956 and has been a field salesman for the Alice store the past 2 years.

J. R. L. Williams is elected ... vice president in charge of European operations for Worthington Corp., announces Walther H. Feldmann, president of the Harrison, N. J. manufacturer. With headquarters in Paris, France, Williams will coordinate all production, engineering, sales, and service functions of seven associate companies located in Austria, France, Germany, Italy, and Spain.

J. R. L. Williams

He will also be responsible for integrating the output of these plants with exports from the United States, and maintaining liasion with a number of European licensee manufacturers. Williams joined Worthington in 1959 as general European manager. Previously he was with International General Electric Co., serving in various capacities outside the United States.

James T. (Jim) James joins ... the sales force of Frank W. Murphy Mfr., Inc., Tulsa manufacturer of safety switch-gages and automation devices. James has been in charge of pumping-unit sales of Bethlehem Supply Co. for the past several years.

Westinghouse Electric sets up ... a new industry systems department with responsibility for the conception, development, design, and sale of complex systems for control of processes in industry, announces Mark W. Cresap, Jr., president. At the same time, Cresap reported the election by the board of directors of Dr. Patrick Conley as a vice president with responsibility for industry engineering apparatus, service, and the newly created industry systems department. Dr. Conley, who will be located at East Pittsburgh, will report to A. C. Monteith, vice president of the apparatus products group.

Ampco Metal, Inc. appoints ... George Yardley Co., Santa Ana, Calif., as a distributor of corrosion and erosion-resistant centrifugal pumps. The new distributor will handle Ampco's line of pedestal and close-coupled pumps in aluminum bronze, 316 stainless steel, and Illium "G."

Gar Wood forms new division ... to manufacture and market to original equipment manufacturers a complete line of hydraulic pumps, valves, and other components. The hydraulic division will headquarter at the corporation's executive offices in Wayne, Mich.

Harold E. Felix appointed veep ... and director of engineering at Midwestern Instruments, Inc., in which post he will cover the entire field of electronic instruments manufactured by the Tulsa company. Felix joined Midwestern after 21 years of design-engineering experience with Douglas Aircraft Co.

Gilbert R. Shockley is named ... general director of Reynolds Metals Co.'s product development division. He will be in charge of the company's development laboratories in Richmond and Louisville. Formerly vice president for metals in the international division of Olin Mathieson Chemical Corp., Shockley joined Olin in 1953 as manager of chemical-process development in its general research organization. In 1957 he became vice president, research and development, metals division. Previously he was with Eimco Corp., Salt Lake City.

Producers Supply & Tool opens ... a new store at Palestine, Tex. Personnel will be B. E. (Earl) Young, manager; with T. J. Stehlik and D. E. Kinnett transferring from Wichita Falls, and J. W. Kitchings moving from Snyder, Tex.

Alco Products, Inc. elects ... William G. Miller as executive vice president. A director since 1959, he had been vice president in charge of the company's thermal and petroleum-industry-equipment groups since 1960. Alco's board chairman, Perry T. Egbert, said that in his new position Miller will continue his responsibility over the process-equipment groups and, in addition, will report to him on engineering, manufacturing, and purchasing functions. Miller joined Alco as a project engineer in New York in 1932.

W. G. Miller

Technical Oil Tool expands ... its force of sales and service specialists, according to John Davis, general sales manager of the Los Angeles manufacturer. In the Shreveport area, B. Ray Lummus will work under the direction of Gene McConnell, Totco vice president. Arnold F. Koenig joins Eldon Snyder, Totco district manager, in Casper, Wyo.

C. E. De Young elected president ... of Detailed Engineered Equipment Corp., with office and plant facilities at Houston. De Young has had several years experience in domestic and foreign equipment application and design problems. Deeco provides design and fabrication facilities for the pipeline, process, and production phases of the oil industry.

Major Engineering announces ... shareholder approval of the sale of manufacturing rights, designs, and inventory of the company's automatic lease equipment products. Jones & Laughlin Supply Division will acquire Major MACT (meter automatic custody transfer) units, prover tanks, pressure switches, meter monitors, and gage glasses. J&L has been exclusive distributor for Major products.

Major Engineering Co., with factory and offices in Tulsa, was established in 1957 by Ralph W. Hill,

then senior mechanical engineer with Pan American Petroleum Corp. Since its inception, Major has built standard, packaged, meter automatic custody transfer units, in sizes from 500 to 4,000 bbl. per day.

Chester W. Nimitz, Jr. elected

. . . a vice president of Perkin-Elmer Corp. and general manager of its Instrument Division. He resigned from Texas Instruments, Inc. to acecpt the position. Nimitz joined Texas Instruments in 1957 after 21 years of service with the U. S. Navy. In 1958 he was appointed controller of the firm's Apparatus Division. A year later he became manager of the Industrial Instrumentation Division, which later became the Industrial Products Group of the Apparatus Division.

Oil Center Tool Co. appoints

. . . Denali Services Co., Anchorage, Alaska, as sales representative for the state of Alaska. Denali Services was recently organized by William F. McClure and G. H. Osborn. The company maintains a stock of O-C-T wellheads, chokes, and other surface flow-control equipment at its warehouse in Soldotna, near the Swanson River oil field.

In another move by Oil Center Tool, George Young was named sales-service representative at Hobbs, N. M. Young has 8 years experience as an oil-field sales representative in Hobbs, being associated with Magneto Service & Supply Co., United Supply & Mfg. Co., and Union Supply Co.

Black, Sivalls & Bryson names

. . . Robert L. Kelly as product supervisor of automation equipment, according to Paul Bartley, sales vice president. Kelly, who will provide technical assistance to other BS&B salesmen on automation equipment, has more than 5 years experience in the sales of this equipment. He will headquarter in Oklahoma City.

Bartley also announced the appointment of two branch managers—James M. Clayton at Shreve-

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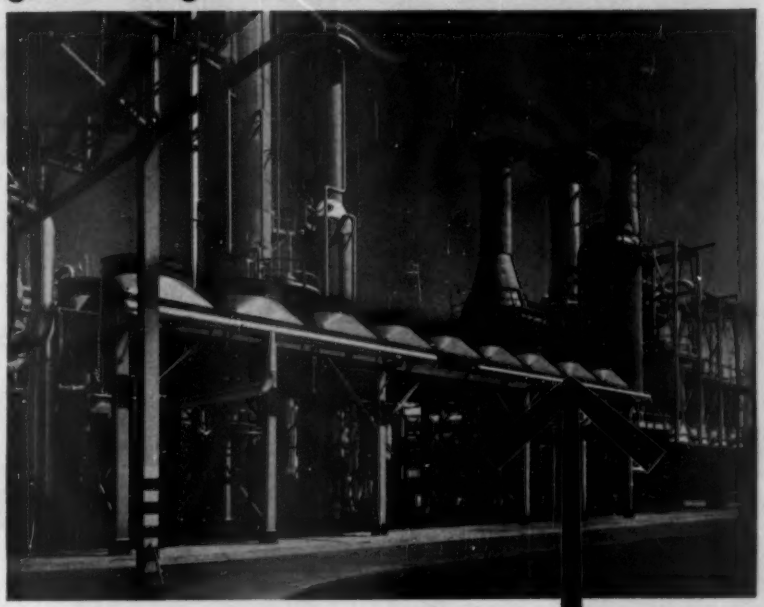

improves process cooling rate, resists corrosion at Southwestern Oil & Refining Company's Big Texas Refinery

Aluminum's superior ability to transfer heat finds practical employment in this Solo-Aire cooling installation, made with ALCOA® Aluminum by Hudson Engineering Corporation, Houston, Texas. Light, bright aluminum has other advantages here: notable corrosion resistance and remarkable low-temperature properties. Installed at Corpus Christi, Solo-Aire is clear evidence of another good design made better with aluminum. Perhaps ALCOA can help improve your good designs. For more information, please mail the coupon.

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- ☐ 02-19051 Alcoa Aluminum Handbook
- ☐ 42-20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 34-20437 Aluminum Alloy Heat Exchangers in the Process Industries

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Now the proven Grove Seal-"O"-Ring® design is ready in a compact regular port gate valve. Round opening (1) assures flow characteristics superior to plugs. Double-barrier seal gives positive metal-to-metal contact (2) backed up by protected o-rings (3) to keep gate clean, smooth for fast open/close. Non-rising stem (4) and "designed-in" compactness achieve overall height of only 14⅜". G-6 Regular Port gate valves, like all Grove valves, do not rely on sealing compounds for bubble-tight shut-off, thereby eliminating costs relative to this maintenance. Ready now in 2" ASA 900 and 1500.

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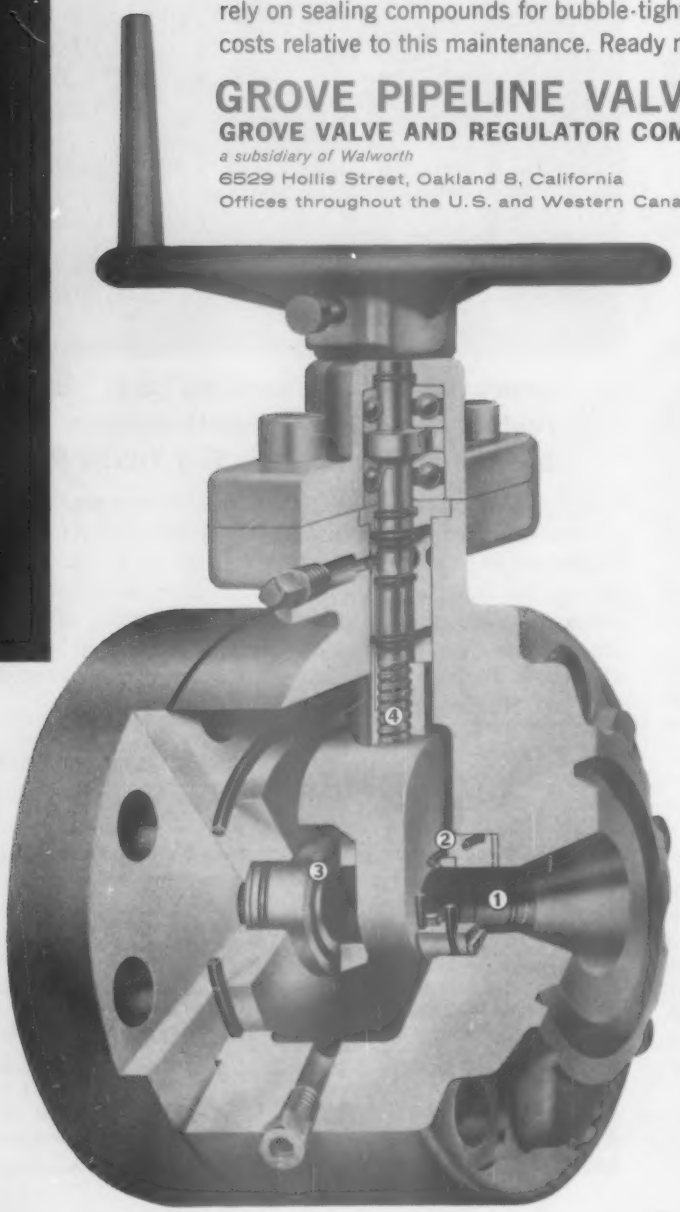

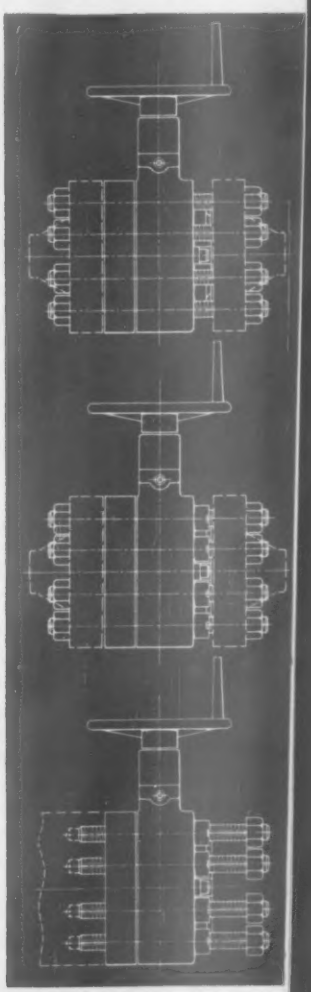

port, and Charles L. Rhodes at Hobbs, N. M. Clayton moves from his previous position as branch manager, Venezuelan Division of BS&B International, S.A. Rhodes joined the company in 1953 and has served as sales engineer in the Midland-Odessa area for the past few years.

Carlton C. Davis, Jr. becomes . . . manager of Elliott Co.'s compressor sales department, according to J. W. Anne, general manager of the Jeannette, Pa. concern. Davis joined Elliott in 1943 as a member of the compressor engineering department in Jeannette and spent 5 years with this group. He became a member of Carrier Corp.'s compressor engineering department in 1951, moving into sales in Cleveland the following year. With the merger of Carrier and Elliott, Davis was appointed compressor specialist for the central region, handling sales of both compressor lines.

C. C. Davis, Jr.

Sargent Engineering Corp. forms . . . a new sales district in the area of their store points at Bakersfield, Taft, and Ventura, Calif. R. C. Manning has been placed in charge of the district, according to V. E. Boyer, division sales manager. Sargent Engineering manufactures rod insert and rodless hydraulic oil-well pumps.

Iverson Supply opens branch . . . supply store in Hobbs, N. M., which will offer a complete line of oil-field supplies and equipment. Heading the staff at the new facility will be L. Dean Halliburton, sales representative, who for the past 11 years was with Jones & Laughlin Supply Division; and Fred N. Williams, store manager, formerly located at Iverson's Artesia branch.

Continental-Emsco to represent . . . products of two companies—Besly-Welles Corp.'s Cutting Tool & Gage Division, and Wheel Trueing Tool Co. For Besly-Welles, located in South Beloit, Ill., C-E will represent their line of taps, X-press taps, gages, drills, reamers, and end mills. Following the agreement with

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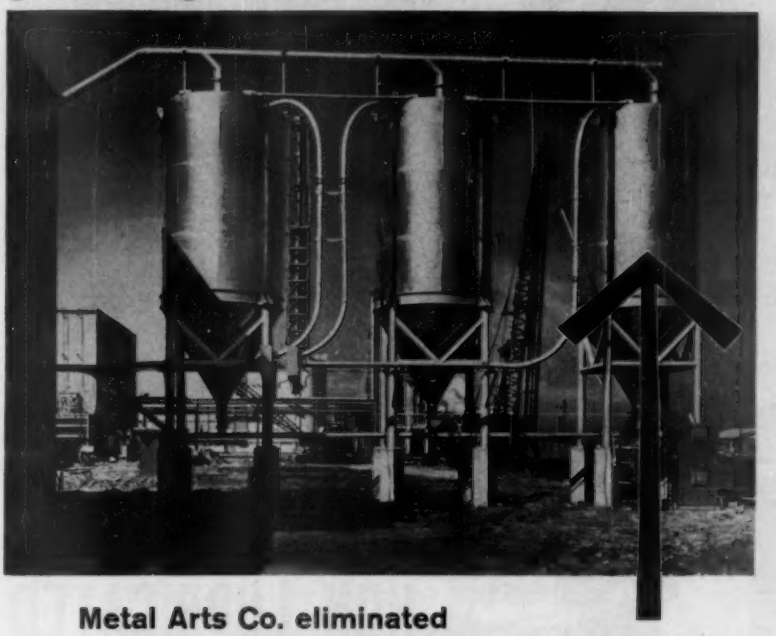

Metal Arts Co. eliminated product contamination in bins and piping at Koppers polyethylene plant

Originally selected for initial low cost, aluminum proved a good design specification for bins and conveyor piping at the Koppers plant, Port Arthur, Texas. Used in polyethylene production, these units have eliminated undesirable metallic contamination of the product — thanks to the chemical stability of aluminum. Bins were designed and fabricated by Metal Arts Co., Houston. Here, again, is a case in point showing a good design made still better by the valuable chemical and physical properties of ALCOA® Aluminum. The coupon will bring you detailed information on how to make improvements in your own good designs.

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- ☐ 34-20437 Aluminum Alloy Heat Exchangers in the Process Industries
- ☐ 50-19415 Welding Alcoa Aluminum
- ☐ 02-19051 Alcoa Aluminum Handbook

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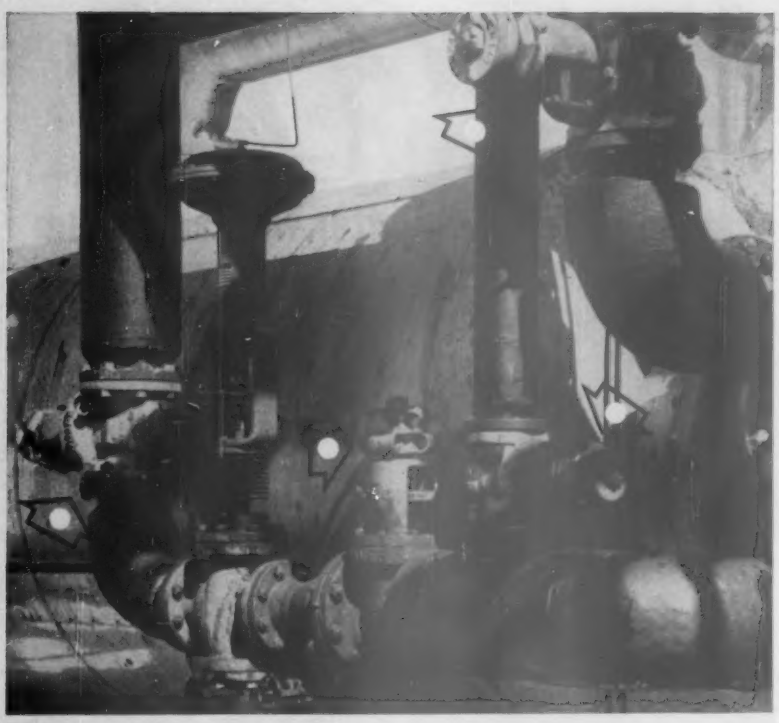

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Hamer non-lubricated, non-sticking plug valve with gland packed stem seal. Standard opening. Sizes 1" through 12", in ASA 150 lbs. and ASA 300 lbs. series. Available in carbon steel and other metals to meet special corrosive and temperature conditions.

In such services as hot oil, LPG, hydrocarbons and others where lubrication is a source of trouble and expense the non-lubricated, non-sticking features of Hamer Plug Valves prove their real worth.

Non-lubricated means there is no danger of product contamination . . . no need for lubrication and maintenance. Non-sticking means easy operation at all times under high temperatures. A powerful screwjack lifts the plug off its seat for easy opening and closing.

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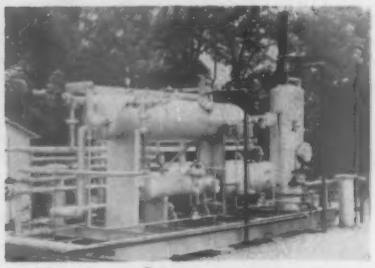

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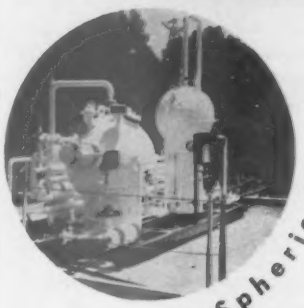

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Wheel Trueing, of Detroit, Continental-Emsco will represent their line of industrial diamonds, diamond tools, and diamond dressing devices on an exclusive basis in Houston and South Texas.

Atlas Bradford supply store . . . has been opened in Ozona, Tex. under management of Bill Myers. T. H. Wellman is salesman in that area.

Hydromatics, Inc. appoints . . . Madden T. Works as chief engineer for the production of Flo-Ball valves, according to Bernard L. Moss, president. Works has a background of 30 years in valve engineering and production and oil-field-equipment engineering. Before joining Hydromatics he was manager of operations for Turbodrill Division of Dresser Industries, Inc., in Dallas.

M. T. Works

Prior to this Works was president of Pioneer Specialties, Inc., for almost 3 years, manufacturing oil-field equipment. He was with Cameron Iron Works, Houston, for 22 years, starting as a draftsman and field service man in 1932. When he left Cameron to join Pioneer in 1954 he was chief engineer of the Valve & Oil Tool Division.

Clark Bros. Co. appoints . . . James D. Gilbride as California district manager in Los Angeles, reports George W. Probst, vice president of sales. Gilbride joined Clark in 1949 as an engineer in the technical service department. Two years later he was named sales engineer for the Clark Pittsburgh district. In 1957 he joined Clark Compressor Co., Ltd., as Toronto branch manager and subsequently was named district manager of the Canadian territory.

J. Eugene McCarthy has been named Canadian district manager for Clark Compressor Co., Ltd., with offices in Calgary, Alta. His appointment fills the vacancy created by Gilbride's move. John Pyles has been named Toronto branch manager for the Canadian firm.

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All-aluminum cooling system reduces danger of water contamination in Brookhaven's new Synchrotron

More than one mile of aluminum piping and some 2,600 FLOWLINE aluminum fittings comprise the magnet cooling system at Brookhaven National Laboratory's new Alternating Gradient Synchrotron. High-purity water at 65°F is circulated through an aluminum piping system to cool electromagnets arranged in a one-half mile long circular ring; the water is then returned to heat exchangers. Because the conductivity of the water must be kept below 11 micromhos, aluminum was selected for its superior resistance to corrosion. View of pump room above shows sections of aluminum piping; FLOWLINE tees, elbows, and reducers, made with ALCOA® Aluminum by Flowline Corp., New Castle, Pa. For more information about aluminum's applications and versatility, please send the coupon.

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- ☐ 34-10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ 68-10460 Process Industries Applications of Alcoa Aluminum
- ☐ 88-11453 Solving Refinery Corrosion Problems with Aluminum

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STABBING A LENGTH of drill pipe in Delta Drilling Co.'s Rig 34. Using the same 8,000-ft. string of Spang drill pipe, this rig drilled 71 wells, totaling 473,336 ft., during a 7-year period, in hard formations in and around Clearfield County, Pennsylvania.

Same string drills 71 wells

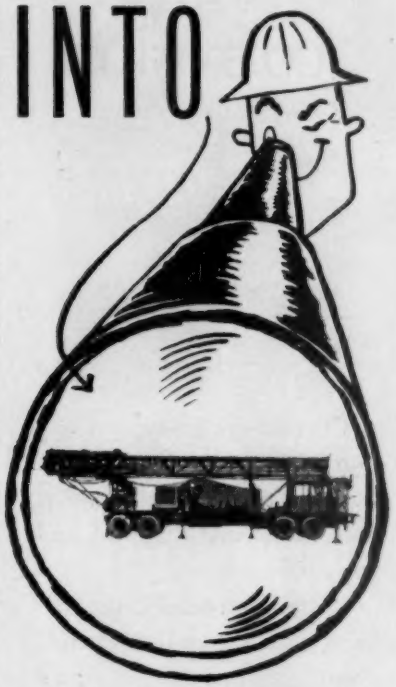
GOOD drilling practices have enabled Delta Drilling Co. to obtain extraordinary service from an 8,000-ft. string of drill pipe.

In a 7-year period, the string has drilled 71 wells, averaging 7,200 to 8,000 ft. deep, for a total of 473,336 ft.

The operations were with Delta Rig 34 in hard formations in and around Clearfield County, Pennsylvania. Although 400,000 to 500,000 ft. can be obtained in soft formations, a drill pipe life of 100,000 to 125,000 ft. is considered good in hard formations.

As is customary in the area, air instead of mud was circulated for

WORTH LOOKING INTO



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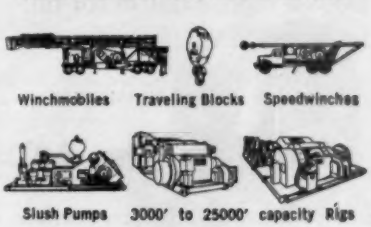

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the removal of cuttings. Delta has five compressors which force air down the drill pipe at the rate of 2,200 c.f.m. at 150 to 170 psi.

The string is of 4½-in. by 16.60-lb. Spang Grade E drill pipe equipped with 6-in. o.d. Spang full-hole double-seal shrink-thread tool joints, manufactured by the National Supply Division of Armco Steel Corp.

On a typical 7,100-ft. well, Delta used three 8-in. and eleven 7-in. drill collars, for an actual collar weight of 50,000 lb. The string was rotated at 65 r.p.m. Use of adequate drill-collar weight, rotating the pipe at low speed, and keeping the pipe in tension are believed to explain the exceptional service record of the string.

H. J. Magner, vice president of the company, is responsible for drilling operations in the eastern region. M. L. Eakins is the tool pusher on Rig. 34.

Because of the drill string's outstanding performance, National Supply examined samples in the laboratory of its seamless-tubular-products plant at Ambridge, Pa. Two sections, about 26 in. long, cut from the same length of pipe, were subjected to dimensional and microscopic inspection, analysis of the mechanical and chemical properties, and other tests. A tool joint from the string also was inspected.

The laboraory report concludes: "The rather uniform wear over the tool joints and no appreciable wear to the pipe is indicative of recommended drilling practices, such as slow rotation speed, adequate drill-collar weight, and keeping drill pipe in tension at all times. It would be difficult to predict just how much additional life remains in the string, but if the customer continues his operations under similar techniques as in the past, the already excellent record could soar to a more enviable height."

Footage Record

Year	No. wells	Footage drilled
1954	12	70,405
1955	5	33,668
1956	10	65,120
1957	12	73,834
1958	9	63,790
1959	12	86,633
1960	11	79,886
Total	71	473,336

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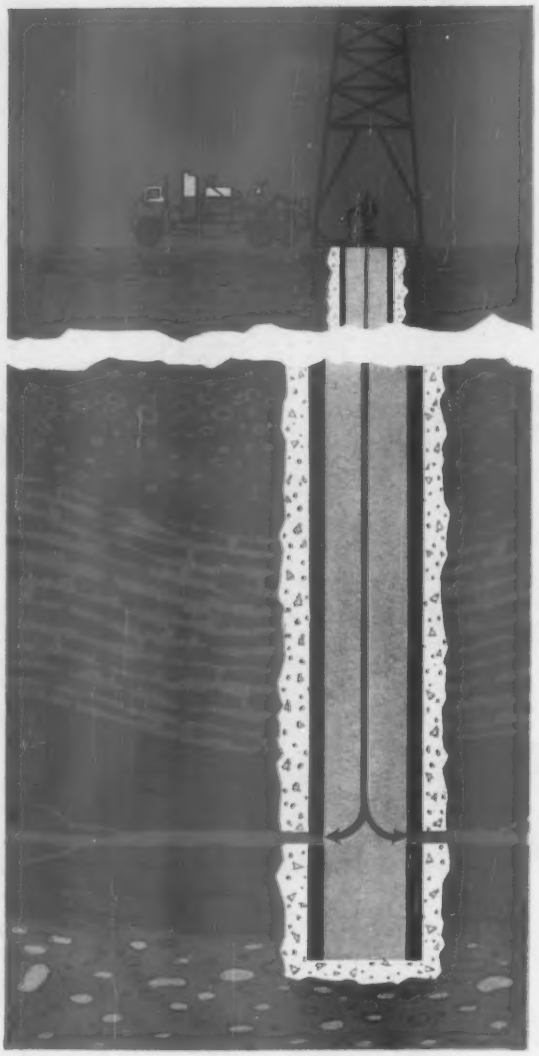

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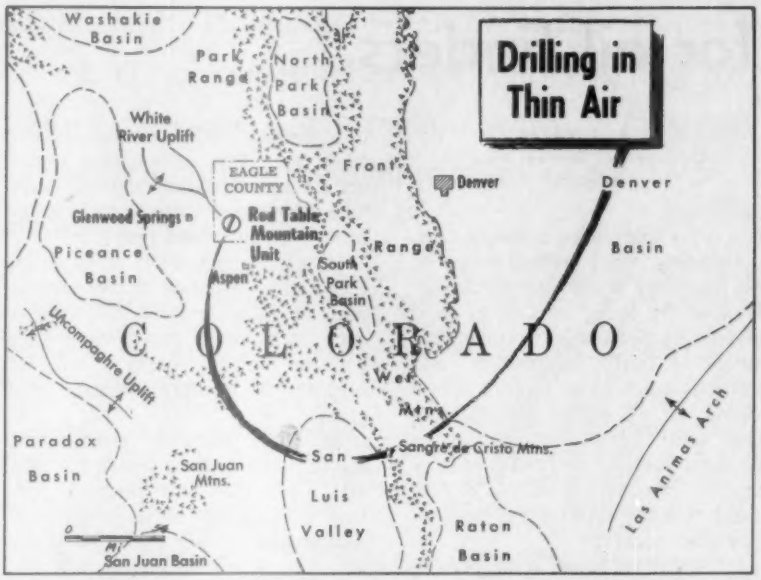


IN THE MOUNTAINS of Northwest Colorado, Pan American Petroleum Corp. will drill the 1 Unit-Tully at what is believed to be the highest elevation yet recorded. This first test of the Red Table Mountain unit will spud at 11,200 ft. above sea level. Noble Drilling Co. is moving in to the location now.

Pan Am high on its mountain wildcat

BY FRANK J. GARDNER

A "really woolly wildcat" will spud soon in the mountains of western Colorado. That's the way Pan American Petroleum Corp. describes its 1 Unit-Tully, first test of its Red Table Mountain unit, Eagle County.

As far as can be determined, this will be the highest well ever drilled. Surface elevation at the drill site, in Section 30-6s-85w, is 11,200 ft. In the rarefied atmosphere of Red Table Mountain, a large surface structure 12 miles southwest of Eagle townsite, and 19 miles southeast of Glenwood Springs, Noble Drilling Co. is moving in equipment this week and will commence operations soon. Noble is making use of old logging roads in the vicinity as much as possible.

Target of the 1 Unit-Tully is the Devonian-Chaffee zone at about 7,000 ft. If the well is successful, the producing zone would lie nearly a mile above sea level. This is the first test of the 42,849-acre unit; nearest previous drilling was a Champlin Oil & Refining Co. duster just east of Eagle in Section 4-5s-84w, abandoned at 6,321 ft. in 1949. The nearest production is 26 miles to the west at Baldy Creek field, a Mesaverde-Cretaceous producer at a depth of 10,256 ft.

A surface prospect . . . Here's one wildcat that's based strictly on surface geology. Pan Am tried the seismic approach, but problems of terrain defied its crews. Red Table Mountain is an elongated surface anticline and tectonically a part of the White River uplift of northwestern Colorado.

No particular drilling problems are anticipated by Noble Drilling. The contractor expects to use air as the drilling medium through the shallow formations, where lost-circulation zones are known to lurk, but the bottom half of the hole will be drilled with conventional mud system.

May break a record . . . Producing fields at such high altitudes as this are no novelty to Rocky Mountain companies, but nothing yet exists above 10,000 ft. Record holder at the moment is Joe's Valley field, Sanpete County, Utah, where elevations run to 9,725 ft. Other "way up" fields include Middle Mountain, Sweetwater County, Wyoming (9,311 ft.); Wilson Creek, Rio Blanco County, Colorado (8,400 ft.); and the North Park basin fields in Jackson County, Colorado, at 8,200 ft. Canada's only producing field in the Rocky Mountains is Savanna Creek in southwestern Alberta with elevations up to 8,134 ft.

The nearest drilling to the new wildcat, as mentioned earlier, was 12 miles to the northeast at Champlin 1 Black, 12 years ago. A peculiar situation existed at that site—the well spudded in Minturn-Pennsylvanian rocks, and found no other formation to total depth 6,321 ft. It bottomed in Minturn. "We hope for better luck at our well," says a top Pan Am geologist. "We'll spud in Pennsylvanian too, but we hope to bottom in the Devonian."

Permian and Pennsylvanian stratigraphy in the southern half of the White River uplift is easily observed in surface exposures[1], but the pre-Pennsylvanian section in the immediate area of Red Table Mountain is less well-known. The Chaffee, target of Pan Am's wildcat, is Upper Devonian in age and is the approximate equivalent of the Ouray limestone of the Four Corners region.

Structurally, this is an extremely complex region, shot through with high-angle faults, thrusts, and folds. The well site lies between the White River uplift to the northwest and the Sawatch uplift to the southeast.

It will be an interesting operation to watch. And in the August days ahead, Pan Am will probably have no trouble recruiting volunteers to visit the well.

Reference

1. Symposium on Pennsylvanian Rocks of Colorado and Adjacent Areas, published by Rocky Mountain Association of Geologists, Denver, 1958.

Gravity-magnetics can be an effective tool for oil finders

BY R. A. GEYER
Geophysical Service, Inc.,
Houston

BOTH gravity and magnetics have distinct individual as well as collective applications in petroleum exploration. When used separately they can provide valid answers to many geologic questions, but both methods achieve their utmost effectiveness when used in combination.

Gravity and magnetics have "been around" for many years. They are two of the oldest geophysical tools, and yet are often two of the most misused and misunderstood. Both techniques are easy to apply from the standpoint of collecting field data, and they are relatively inexpensive when compared with the seismograph. However, gaining a correct interpretation of the field data is far from being a simple task.

To apply either method properly, it is necessary to consider the limitations of the tools, as well as their advantages. Since a gravity-magnetic survey is fairly inexpensive, and proceeds much more rapidly than a seismic survey, some explorationists have said "Let's do a gravity or magnetic survey," without first stopping to consider if such a survey could possibly provide the answers they were seeking.

On the other hand, some persons look askance upon these methods, and proceed to spend their exploration dollars on a seismic survey, when the same information under certain circumstances could have been obtained with gravity - magnetics—cheaper and faster.

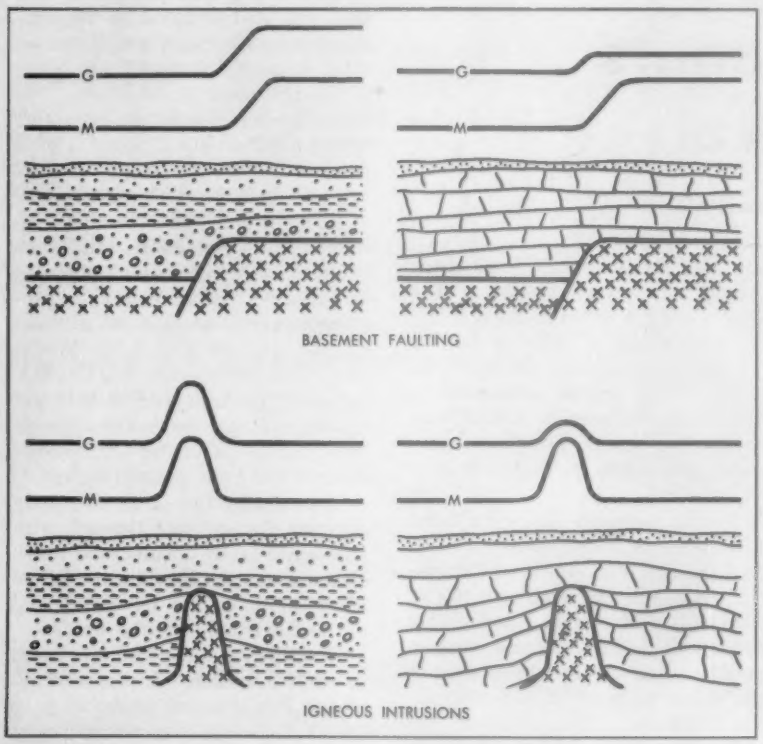
If enough thought is given to an exploration situation before operations begin, a qualified geophysicist can determine if gravity-magnetics will do the job, or if it will be necessary to institute a seismic program.

In 1640, Swedish miners used the compass in their search for iron ores, and this was probably the first application of a geophysical tool toward solving a geologic problem. Von Wrede theorized, in 1843, that local variations in the earth's magnetic field might be indicative of buried magnetic materials. Surveys for deposits of iron ore—and even gold—were successfully conducted in Europe and the United States in the 1800's. However, with the advent of the Schmidt field magnetometer in 1915, an instrument became available that was sufficiently accurate and portable to be used for measuring magnetic anomalies of small magnitude in the field.

As a tool for petroleum prospecting, the magnetometer performs more of an indirect role, rather than as a specific means for locating possible petroleum - bearing structures. However, as is the case with many exploration methods, the use of magnetics in exploration is many times limited only by the ingenuity of the explorer.

For example, magnetic surveys have been used to locate water wells in South Africa—when their location was controlled by basalt dikes. And, gold, in conglomerates overlain by magnetic shales, also has been found indirectly with magnetometer surveys in South Africa.

In petroleum exploration, either the ground or airborne types of magnetometer can yield information on the areal extent and configuration of sedimentary basins and the thickness of these basins, based on depth - to - basement computations. Determinations can be made regarding the presence or absence, and



COMBINED gravity-magnetic profile has stratigraphic applications. Together these tools can define basement faulting and igneous intrusions. Note the effects produced with igneous rocks and clastic sediments (left, top and bottom), and igneous with carbonate beds (right, top and bottom). Prime difference is gravity profiles over igneous-carbonate (right) do not have as great a density contrast as a magnetic contrast. All four examples have good magnetic contrast. Fig. 1.

"In theory, and usually in practice, one plus one equals two. However, when an explorationist adds the results of a magnetometer survey to a gravity survey, he obtains information which is much more valuable than just the simple sums of the two methods."

Dr. R. A. Geyer

. . . is now gravity operations manager, Geophysical Service, Inc., Houston. Beginning in 1946, he was engaged in the coordination of geophysical research in the exploration department of Humble Oil & Refining Co. During this period he also did special work in connection with oceanographic engineering problems, and served as chairman of the wave-force research committee of the offshore operators committee. He has been a part-time faculty member of the department of physics and geology of University of Houston since 1948, instructing in geophysics ad marine geology; and was editor of Geophysics from 1949 to 1951. He is a graduate of Princeton University and is a member of SEG and AAPG.

the depth and configuration, of igneous intrusions. Structures involving basement rocks frequently can be located indirectly by magnetic surveys, and, through magnetics, we can develop criteria to determine also the geologic origin of gravity and seismic anomalies in areas where igneous rocks comprise an important part of the geologic column.

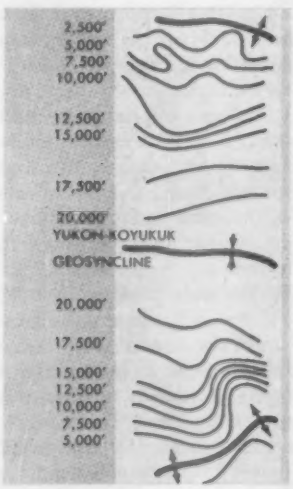
Remember—a magnetic map is nothing more than an indication of the distribution and concentration of magnetite. As such, it has very little definite direct bearing on petroleum exploration, but its value becomes evident when the magnetic information is combined with gravity and geologic data.

Similarly, a gravity map by itself has no value as a tool for uniquely indicating the hiding place of a subsurface oil trap. It is only a record of the variations in density due to some anomalous subsurface condition. The cause of this anomaly, and its possible connection with an oil-bearing structure is something which must be determined by further interpretation using available geologic and other geophysical information.

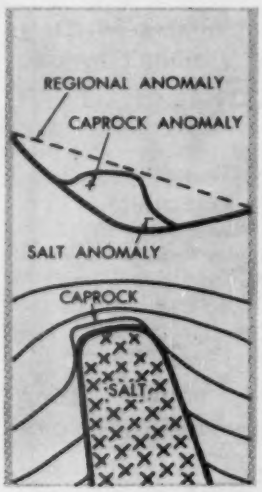
The data obtained in the field with a gravity meter contains some inherent effects which must be taken into consideration, such as instrument error, temperature and barometric changes, variations in gravity readings due to shallow geologic conditions, corrections for meter drift, earth tides, and microseismic movements, and the ever-possible human instrument observation error.

When these effects are taken into account properly by the gravity interpreter, and the resulting meter readings multiplied by the meter constant, the results are "raw" field gravity data—which must then be subjected to other corrections involving such factors as station position locationing, density of near-surface material, terrain, elevation and latitude. After these have been computed and combined with computations relating to the theoretical gravity value of a particular station location, then the resulting values can be plotted and contoured to yield an accurate Bouguer gravity anomaly map.

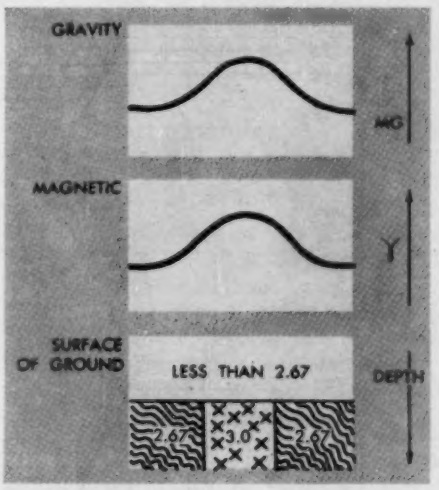
This Bouguer anomaly map must then be interpreted in terms of var-



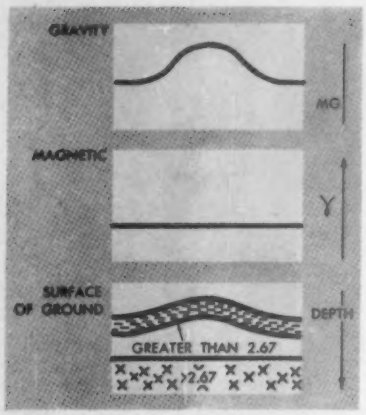
AEROMAGNETIC flight lines here in Alaska determine basement topography and whether igneous intrusions exist. Flown by USGS. Fig. 2.



GRAVITY can find salt domes due to less dense salt and more dense caprock than other beds. Fig. 3.



INTRABASEMENT feature is mapped because density and magnetic content of intrusion is greater than rest of basement and overlying sediments. Fig. 4.



STRUCTURE in beds of greater density than others over a basement with constant susceptibility and no relief will show anomalous by gravity and flat by magnetics. Fig. 5.

ious theories to provide a residual anomaly map which can be related to subsurface structure. This map is sometimes also referred to as a "raw," "total," or "unobserved" gravity map. The residual map does not contain any new information that is not available from the Bouguer map. It serves merely to accentuate the gravity contributions arising from specific targets of an exploration program and suppress those caused by other geologic features. This is analogous to the effect of filtering and compositing in seismic-data interpretation.

"The deeper the target, the greater the areal extent of its associated gravity anomaly."

A similar complex series of corrections and computations must be made to provide an accurate magnetic map that can be used successfully as an aid to exploration regardless of whether the data are obtained by a land-type instrument or with an airplane.

In making recommendations for or against the use of gravity or magnetics in a particular exploration program, the geologic target of the proposed program is the prime criterion.

There are certain variables connected with the target that constitute the limiting factors to be considered in deciding to use or not use gravity or magnetics. These factors are the size and relief of the target structure, its density or magnetic susceptibility contrast with surrounding formations, as well as its depth, shape and the degree of isolation.

In using gravity to solve local geologic problems, the approximate size of a target should be determined in advance of exploration, since it influences the amount of coverage needed to delineate the target. For example, the deeper the target the greater the areal extent of its associated gravity anomaly. If a fault to be defined by gravity is 5,000 ft. deep, about 20,000 ft. of linear coverage perpendicular to the trace must be metered for a positive delineation.

By using geologic knowledge of an area it can be determined whether a structure for a given depth has sufficient density contrast (in the case of gravity) or susceptibility contrast (magnetics) with the surrounding formations or expected relief to yield a recognizable anomaly in a gravity or magnetic survey.

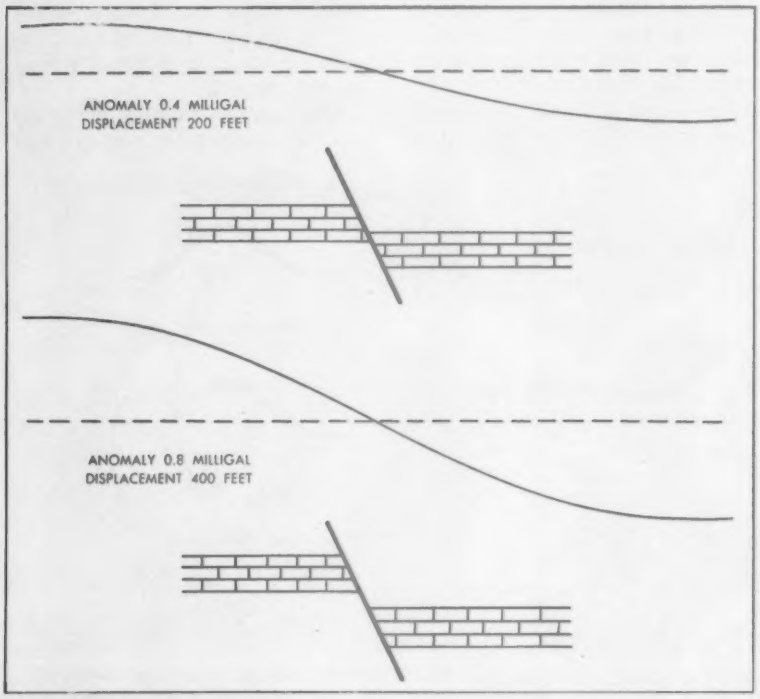
The degree of isolation of the target is another variable. For example, two faults 1 mile deep must be at least 1 mile apart to provide sufficient resolving power so that they can be mapped as individual anomalies, rather than as a single anomaly indicative of a fault zone.

The foregoing variables which must be observed carefully in the field, and the numerous computations necessary to turn raw field gravity or magnetic data into information which is of value to the oil hunter, might tend to build a feeling of reluctance toward the use of these tools in persons not fully acquainted with the methods.

However, it should be emphasized that no exploration method is a panacea. The results obtained from any technique are only as good as the quality and amount of work, thought, and interpretational ingenuity which goes into applying the technique.

The available geologic as well as other types of geophysical information must be included to achieve maximum results in interpreting the geologic significance of gravity and magnetic anomalies. This cannot be done mechanically by using digital computers to compute second vertical derivative maps.

It requires experienced human beings, well-qualified academically, to perform successfully the necessary interpretive procedures.



FAULTS defined by gravity depend on density contrasts, depth, amount of throw, and thickness of faulted bed. - Throw is computed using average density contrasts between faulted beds, and between faulted bed and surrounding beds. Fig. 6.

New oil pool, gas pool discovered in Illinois

ONE NEW OIL POOL, Mode in Shelby County, and one new gas pool, New Athens in St. Clair County, were discovered in Illinois this June.

There also were two extensions to pools, one each to Clay City Consolidated in Wayne County, and Siggins pool in Cumberland County.

Three new pay zones were discovered in pools in June. Oil was discovered in St. Louis lime in Johnsonville Consolidated pool in Wayne County, and in the McClosky lime in Trumbull North pool in White County. A gas well was completed in Pennsylvanian sand in Eldorado Consolidated pool in Saline County.

A total of 129 new oil and gas tests was completed in the 4-week period. The new tests resulted in 56 oil wells and four gas wells, a success ratio of 47%. In addition, two wells that previously had been completed as dry holes were reworked or deepened and recompleted as oil wells.

In Oakdale North pool in Jefferson County, about 9 miles northeast of Mount Vernon, James T. Hurt completed his No. 3 Snodsmith well in 3-2s-4e, for a reported initial production of 300 bbl. of oil a day from McClosky lime after acid treatment. Oakdale North pool was discovered in December 1960, and had one oil well at the end of the year. Since then nine additional oil wells have been completed. Reported initial potentials range up to 375 bbl. of oil a day and average 193 bbl. Production is from McClosky lime at an average depth of about 2,925 ft.

Four oil wells were completed in 20 and 29-4s-10e., in Sumpter East pool 2 miles west of Crossville, White County. Initial production ranged from 53 to 120 bbl. of oil a day from Cypress sand and Ohara lime. So far this year 22 oil wells have been completed in these two sections.

Two good McClosky lime oil wells were completed in June in the southwest quarter of 11-3n-7e, 2 miles northwest of Clay City in White County. McCollum & Kincaid's 2 Smith heirs, and W. C. McBride's 3 S. Morgan were completed for reported initial potentials of 225 and 230 bbl. of oil a day, respectively.

Estimated production for Illinois in June is 6,417,000 bbl.

Michigan well gets oil, gas show

In Michigan, Benedum-Trees and Howard Atha 1 Pattee, NE NE SW 28-17n-7w, Orient Township wildcat, Osceola County, carried small show of oil and gas on drill-stem in Dundee at 3,856-67 ft. Operators elected to set casing for production test. The outpost previously had raised interest when it gaged 2,047 M.c.f.d. gas in the Stray sand at 1,495-1,555 ft.

Extreme southwestern Michigan had a play going with C. A. Perry & Son, Inc., 1 Kaminski, NE NW SW 26-7s-15w, Jefferson Township, Cass County, flowing 45 to 65 bbl. oil per day by heads from Traverse limestone at 710 ft. Since 1930 at least four areas from 3 to 10 miles from the Traverse strike have been developed for relatively small Traverse pools, all of which had been abandoned by the first of this year. Perry will test the wildcat but continue with his original five-well Trenton drilling program.

Deep wildcat to test several Kentucky sands

In Elliott County, eastern Kentucky, United Fuel Gas Co. is testing at their deep wildcat 1 Ada Pennington. Well is located in 21-T-70, 1,750 ft. from east line and 5,325 ft. from south line. Total depth is reported at 3,950 ft. with 5½-in. casing run. It is understood that several prospective zones will be tested.

Second Clinton oil well finaled in Ohio area

Waverly Oil Works have a second Clinton oil well on the John Miller tract in Section 10, Fallsbury Township, Licking County.

This north stepout in Fallsburg pool made 110 bbl. in a 8-hour test after fracture. The Clinton sand was logged at 3,042-89 ft. and had 5 bbl. natural with 125 M.c.f.d. of gas.

• In the Logan area where activity has been brisk, J. R. Swingle reports indications of a small pool opener in central Falls Township, Hocking County. The J. B. Wagoner, Section 22, found the Clinton sand at 2,715-40 ft. Four weeks after fracture it tested 5 bbl. oil and 94 M.c.f.d.

New field opened in Nebraska's Red Willow County

Another Pennsylvanian field opened in Red Willow County, southern Nebraska. The discovery well is Simmons Oil Co. and Far West Trading Co. 1 Fischer, C NE NW 25-2n-27w.

The well had a pump gage of 126 bbl. of oil, cut 20% water, daily. Production is from perforations at 3,363-72 ft. in the Lansing-Kansas City lime. Location is 1¼ miles southwest of Silver Creek field, separated by dry holes.

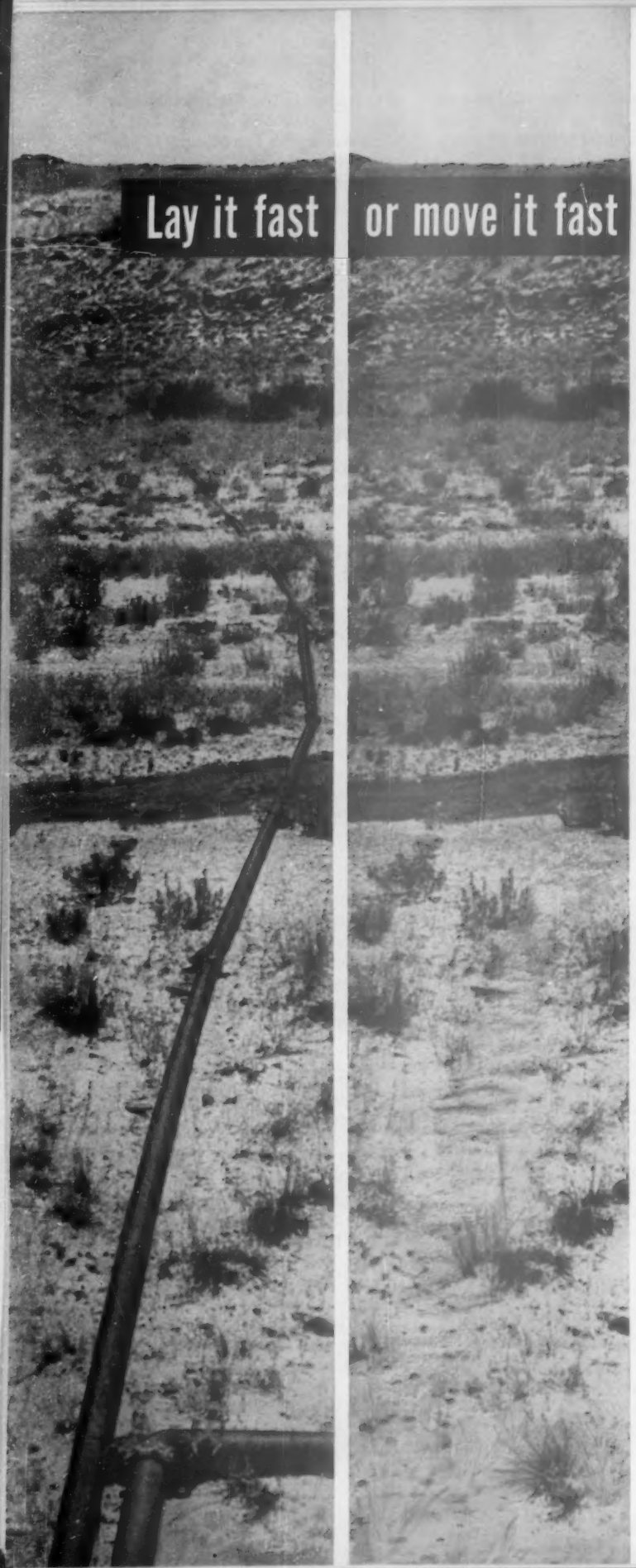
Denver basin. In the Denver basin portion of Nebraska, Stuarco Oil Co. et al. have completed 1 Olsen in C SE NW 10-19n-55w, Banner County.

The well flowed 420 bbl. of oil per day through open 2⅞-in. tubing from "D" Dakota Cretaceous sand at 5,306-14 ft. Location is 1¼ miles north of Davis field "D" sand oil production. Location has been staked for a south offset to the new discovery at 1 Iver Olsen in C NE SW 10-19n-55w.

East extension completed in Louisiana's Bay St. Elaine

Dual completion is reported at U. S. Oil of Louisiana 7 State Lease 2995-LL&E unit 3, an east extension to Bay St. Elaine field in Terrebonne Parish, South Louisiana.

The well was perforation at 14,047-57 and 14,177-90 ft. for completion. The upper zone flowed 276 bbl. of oil per day and 318 M.c.f.d. with tubing pressure 3,250 psi. Flow was through 7/64-in. choke. The lower zone got 342 bbl. of oil per day through 8/64-in. choke and 352 M.c.f.d. Tubing pressure was 3,150 psi.



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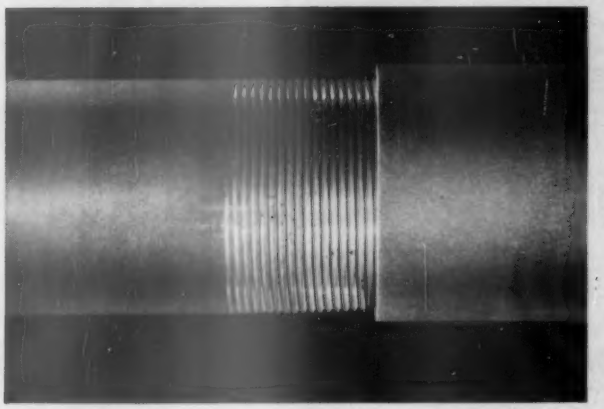

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Four more Swanson River wells completed

IN ALASKA Standard Oil Co. of California announced the completion of four wells in Swanson River field. Just last week two wells in the Swanson River unit (23-33 and 21-15) and one in the Soldotna Creek unit (41-9) were completed. This makes the sixteenth SOCAL completion in 1961, and, a total of 34 completions in the field since drilling began in 1957.

Standard, as operator for Richfield Oil Corp., Union Oil Co. of California, Ohio Oil Co., and itself, in the Swanson River unit announced completion of SRU 23-33 on June 10, with an estimated flow of 300 bbl. of oil per day. SRU 21-15 was completed on June 7 with an approximate flow of 350 bbl. of oil per day.

In Soldotna Creek unit, where SOCAL is operator for Richfield Oil Corp. and itself, completion of SCU 41-9 was announced on June 11. Approximate rate of flow for this eighteenth completion in this unit is 550 bbl. per day—third lowest in the Soldotna unit. SCU 32-8 was rated at 450 bbl. of oil per day and SCU 43-5 was rated at 400 bbl. of oil per day. Most of the Soldotna Creek unit completions run from 700 to 850 bbl. per day.

The 16 wells completed in Swanson River in 1961 are listed above:

Well number	Completion Date	Total depth (ft.)	Est. flow bbl. of oil per day	Field completion No.
SOLDOTNA CREEK UNIT				
32- 9	1-16	10,830	750	19
32- 8	2-22	10,828	450	21
43-33	3- 8	10,995	500	22
12- 3	3-23	10,851	700	24
12- 4	4- 5	10,974	850	26
43- 8	4-24	10,886	700	27
43- 4	5-14	11,048	700	29
43- 5	5-28	10,852	400	30
23- 4	6- 1	10,775	850	31
41- 9	6-11	10,852	550	34
SWANSON RIVER UNIT				
23-33	6-10	10,895	300	33
21-15	6- 7	11,344	350	32
21-27	5- 5	11,142	450	28
23-15	4- 4	11,240	450	25
41-33	3-12	11,133	450	23
23-27	2- 5	11,384	450	20

Only one dry hole was encountered by Standard Oil this year. In the Soldotna Creek unit, 12-16 was plugged and abandoned on April 29 at a total depth of 12,759 ft.

South of Swanson River field in the Falls Creek Unit (near Clam Gulch) Standard Oil drilled a test well, 1 Falls Creek unit, to a total depth of 13,795 ft. It was plugged back to 8,594 ft. and tested for gas. The state Division of Mines and Minerals announced that a commercial gas find was made, however, Standard Oil Co. of Calif. has not yet announced completion of the well.

All oil production in Swanson River field comes from the Hemlock zone (a sandstone conglomerate near the base of the Kenai Tertiary formation) between 10,000 and 11,500 ft. In Soldotna unit, the crude is found closer to 10,000 ft. Flow appears to be greater than in Swanson River unit—where crude appears to flow in less quantity and from greater depths (nearer the 11,000-ft. level).

(Courtesy Alaska Oil Report College, Alaska)

Large gasser reported at Utah's Rock House unit

A big gas well is reported at Shamrock Oil & Gas Corp. 4 Rock House, 1 Unit in SE SE 10-11s-23e, Grand County, Utah. The well flowed 103 M.M.c.f.d. from Wasatch Tertiary rocks at 3,597 to 4,443 ft. Operator says there are 99 ft. of effective pay.

The discovery well at Rock House, 1 Unit in SE SE 10-11s-23e, flowed 12,500 M.c.f.d. from Wasatch, 900 M.c.f.d. from Mersaverde Cretaceous. The 3 Unit in NW SE 11-11s-3e, flowed 2,760 M.c.f.d. from Wasatch and 1,420 M.c.f.d. from Mesaverde. The unit's second well was suspended after flowing only 500 M.c.f.d. from Wasatch. Gas from this unit is slated to Mountain Fuel Supply-Utah Natural Gas Pipeline. The wells will be shut in pending completion of the line.

North Dakota discovery finaled in Billings County

A new Bakken and Three Forks, Mississippian and Devonian, discovery is reported in Billings County, southwestern North Dakota. The discovery is Shell Oil Co.-Northern Pacific Railway Co. 41X-5-1 Federal in NE NE 5-143n-101w.

The new Billings pool opener flowed 136 bbl. per day through 16/64-in. choke from perforations at 10,682-92 ft. and 10,705-15 ft. in the Bakken and Three Forks, respectively.

This is the second strike by these operators on the Medora block. Rough Rider was the first. That 1960 discovery is 9 miles north, producing from Mission Canyon Mississippian.

Casing set at Viola discovery in Kingman County, Kansas

A Viola Ordovician discovery is assured at Stelbar Oil Corp. 1 Nunemaker in C NW NW 26-28s-7w, 3 miles southeast of Kingman in Kingman County, Kansas.

The well, ¾ mile southwest of production separated by a dry hole, flowed 60 bbl. per hour during tests at 4,342-62 ft.

Graham County. Empire Drilling Co. opened Culp field 13½ miles southwest of Hill City at 1 Culp "A," C NW NE 21-19s-24w, 1½ miles southeast of Bryan field.

The well made 166 bbl. of oil per day from Lansing-Kansas City Pennsylvanian perforations at 3,839-45 ft.

Better Production Tools Through Research

OTIS Equipment NEWS

Volume III, Number 2 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Otis 1¼" I. D. Gas Lift Valves Lift 370 BWPD From New Tubingless Completion Gas Well

LAKE CHARLES—A major Southern Louisiana producing company recently used Type C Otis Macaroni String Gas Lift Valves to unload water from a new tubingless completion to save several thousand dollars in swabbing costs. In excess of 18,000 barrels of water were lifted through the 1¼" I.D. tubing and Otis Gas Lift Valves in less than two months time. Following the unloading operation, the pipe was salvaged and the valves exchanged for a new set of a different size for use in one of the company's oil wells.

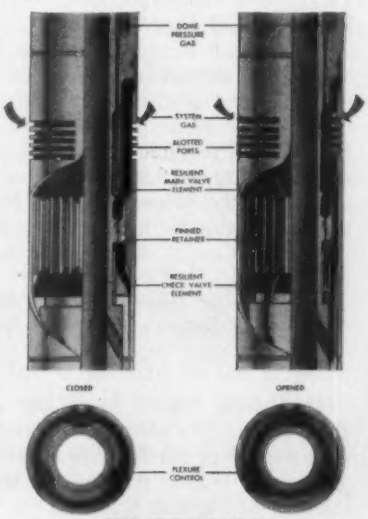
TYPE C OTIS GAS LIFT VALVE

Well conditions at the time the Otis Gas Lift Specialists made their recommendations were as follows: T.D. of the well was 7300 feet. 2⅞" tubing had been run and cemented to serve as a casing. Water encroaching from the down-side of the producing horizon was preventing production.

At the recommendation of Otis Gas Lift Specialists, the operator ran 7250 feet of 1¼" tubing with a packer on the bottom, and nine 1¼" Type C Otis Macaroni String Gas Lift Valves made up in the string. The lowest valve was located at 5900 feet. Using a 900 lb. supply gas system, an average of 370 barrels of water per day were lifted from a valve located at 4400 feet. The injection gas ratio was less than 300 cubic feet per barrel of water. The operator credited Otis Gas Lift Specialists with saving him swabbing costs of between $4,000 and $6,000.

Valve Design Features

Otis Macaroni String Gas Lift Valves provide the same outstanding design features to be found in the larger, standard size Type C Otis Gas Lift Valves. Available in sizes ranging from 1-13/32" to 3" I.D., Type C Valves have a full-opening bore, collar O.D. and tubing I.D., are concentric in design, have only two moving parts — no moving metal parts, no bellows to fatigue, no seat to cut out and no spread. The valve has one operating pressure — the set pressure of the valve.



OPERATING PRINCIPLE TYPE C OTIS GAS LIFT VALVE

Otis Gas Lift Valves are designed to provide the ultimate in lifting efficiency and capacity, and for use in continuous or intermittent lifting operations without modification. Type C Otis Gas Lift Valves with Pack-Off Assemblies are currently being used to convert wells to gas lift without pulling the tubing. This technique of converting a well to gas lift saved one producer as much as $60,000 in converting three readily accessible land wells.

Otis Gas Lift Specialists and Completion Specialists are interested in helping you complete and produce your wells in the most efficient way possible. Their experience — gained through years of solving difficult production problems encountered in all the major producing areas of the world — will prove invaluable to you. Use the knowledge of these men and spend your production dollars more economically and efficiently. For more information on Otis Gas Lift Valves, sizes and lifting capacities, contact your nearest Otis office or write Otis, Dept. E-2, P. O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Gas Lift and Well Completion Specialists ready to help you . . anxious to serve you . . and with the widest variety of field proven production equipment and services available today.

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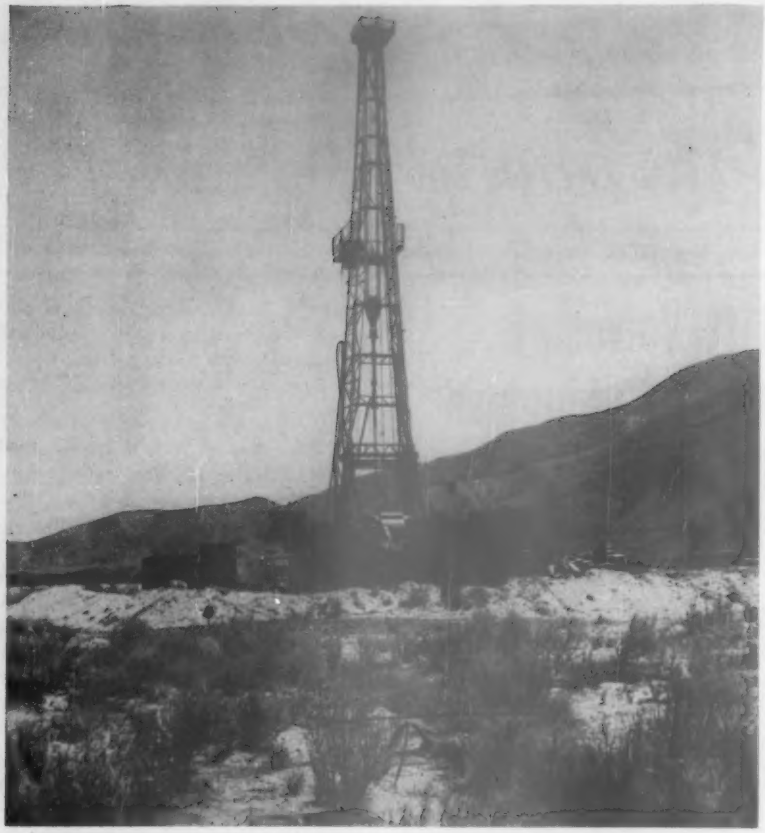


THIS Ventura County, California, wildcat didn't find any oil, but set what may be a record for open-hole drilliing in a directional well. Photo courtesy Shell Oil Co.

Deep California well is duster

THE DEEPEST well drilling in California—a 17,440 ft. venture of Shell Oil Co.—has been abandoned as a dry hole.

Shell's 1 Sloan in the South Piru area of Ventura County (29-4n-18w) may have been a flop as far as finding oil is concerned, but it set what may be a record for open-hole drilling in a directional well.

The 1 Sloan included 15.157 ft. of open hole. The well was deviated 50° with seven whipstocks set between 12,214-14,586 ft. The whipstocks directed the bit under the Oak Ridge fault into a stratigraphic trap in the Santa Margarita formation.

Rocky Mountain Drilling Co., Ventura, contractor on the well, reports the 1 Sloan included more open hole than any other directional well known to the company.

Texaco Inc.'s 1 Lawton in the nearby Fairview Canyon area of Ventura County went to a total depth of 17,485 ft. and included 15,985 ft. of open hole, but the 1 Lawton was a straight hole. Rocky Mountain also drilled this test.

The open-hole section in the 1 Sloan (29-4n-18w) began at 1,693 ft. at the end of the surface string of 13⅜-in. pipe. It ended at 16,850 ft. The well required 166 bits; 134 during the first 16,850 ft. of hole and 32 for the bottom 590 ft. This is about average bit life for this part of Ventura County, according to the contractor.

Shell set the drilling cost for the test at $710,000, which figures out to $40.72 a foot.

Had show. The 1 Sloan had a show of 2 to 2½ bbl. an hour from near the top of the Santa Margarita at around 16,000 ft., but the remainder of the hole was dry.

The deep wildcat is the deepest well drilled in California since Texaco completed the 1 Lawton as a dry hole in 1957. It also ranks as the sixth-deepest hole ever drilled in the state (OGJ, July 3, p. 198). Ohio Oil Co. holds California's deep-drilling record with its 21,482-ft. 72-4 KCL A dry hole in Paloma field.

In addition to the surface casing, Shell hung a string of 7-in. casing to 16,805 ft. and 4½-in. to 17,312 ft.

The Sloan well will go down as another statistic in the growing list of dry holes recently drilled in California.

Shell pointed out in releasing information on the 1 Sloan that only four new field wildcats out of 97 drilled were successful oil discoveries in 1960. One of the four has been abandoned and three others have not proved commercially profitable, according to Shell. So far in 1961 only one new field wildcat has been a successful oil completion (OGJ, June 19, p. 80).

Shallow find ends Sacramento gas slump

THE GAS PLAY in California's Sacramento Valley has pulled out of a summer slump by coming up with a shallow gas discovery in Sutter County after a string of 25 dry wildcats drilled in the last 3 months.

Occidental Petroleum Corp. and Standard Oil Co. of California report the 1 Sacramento Outing Club flowed at the rate of 2,530 M.c.f.d. through a ⅜-in. choke during a 75-minute test. The flow was from a 52-ft. section of the Upper Cretaceous "F" zone between 3,897-3,949 ft.

The test, located in 12-16n-1w, is drilling ahead below 5,100 ft. toward a target depth of 7,500 ft. Occidental is operator on the 6,021-acre block with a 50% working interest in the venture.

The wildcat, which will go down as the discovery well in Butte Creek field, is 2½ miles northwest of another Occidental-Standard gas field discovery, the 1 Standard-Browning, which discovered West Butte field in March. This previous discovery also produces from the "F" zone,

but at about 2,000 ft. deeper than the Butte Creek discovery well.

String of dusters. The Butte Creek discovery is the first new gas field discovered in the busy Sacramento Valley since the West Butte well and a Gulf Oil Corp. wildcat came in 3 months ago.

Two shallow pool discoveries have been made, but no new fields discovered. This low discovery rate compares with a first quarter showing in the valley that turned up three new fields, one new fault block, and three new pools (OGJ, April 24, p. 144).

Union joins Shell and Gulf in offshore Oregon exploration

Union Oil Co. has recently applied for an exploration permit on Oregon's tide and submerged lands. Union thereby joins Shell Oil Co. and Gulf Oil Corp. who are currently doing seismic and sparker-gas-exploder work along the coast.

Union's application now brings to three the companies who have actively entered offshore exploration since Oregon passed legislation in May of this year to allow development of its tide and submerged lands. At least one other major company and possibly two others are expected shortly to file for exploration permits.

Oregon's offshore leasing law has been set up to provide for competitive bidding on maximum acreage parcels of approximately 13,000 acres (3 geographical miles seaward by 6 statute miles along the coast). The primary lease term is 10 years with a 5-year drilling commitment. The state royalty has been set at a minimum of 12½% with an annual rental of 50 cents per acre.

The stakes on Oregon's offshore could be high. On the basis of onshore geology, a major Tertiary basin lies offshore and includes marine sedimentary strata from Eocene through Miocene and possibly Pliocene. Its thickness ranges conservatively from 10,000 to 15,000 ft. The basin has had only two significant onshore tests and no wells have been drilled offshore. For a summary of the geology of Oregon's coastal area refer to "Offshore Oregon Attracts Lease Offer" (OGJ, April 17, 1961) by R. J. Deacon.

Washington hopes are focused on Humble wildcat

Humble Oil & Refining Co. is currently drilling below 3,600 ft. on an important wildcat in western Grays Harbor County, Washington. Humble 1 Ollar-State is projected to test Blakeley (lower Miocene) sands found saturated in Sunshine Mining Co. 1-A Rayonier, approximately 2,500 ft. west of 1 Ollar-State. Projected depth is 5,000 ft.

Humble in a highly significant move for Washington oil and gas exploration recently took a 25,000-acre farmout from Sunshine Mining Co. The agreement reportedly calls for at least two wells. The first well is the currently drilling 1 Ollar-State, Section 24, 20n-12w. The second well will reportedly be near Ocean City where Sunshine Mining Co. startled the industry in 1957 by bringing in its 1 Medina (Section 15, 18n-12w) as a new field, new state discovery. The 1 Medina is currently flowing oil at approximately 3 bbl. per day but originally flowed 180 bbl. per day on initial production tests from Blakeley perforations at 3,952-58 ft.

The entry of Humble into Grays Harbor County should mean that the area is going to get a long-overdue program to really evaluate oil and gas-saturated sands which have failed to produce commercial amounts in the past. Grays Harbor County has some local problems that have not been solved. Some of such problems that have plagued past operations include heaving shales, soft, friable bentonitic sands and fractured low-porosity-and-permeability sands, high bottom-hole pressures and high gas-oil ratios. These problems, have of course, been solved in other areas and it seems probable that through a concerted effort of good drilling practice and engineering that they will be solved in Grays Harbor County, Washington. Humble just could be the operator that will really put the State of Washington in the oil business.

World's first septuple completion set for Texas

THE WORLD'S first septuple completion is slated for Matagorda County, Texas Gulf Coast.

Texaco Inc. will complete 1 D. V. McIntosh in prolific Blessing field. The operator has placed two zones of oil pay on production from the single well bore and five gas zones are to be added soon.

There are now three sextuple completions in the world, all in Southwest Texas. Two are Sunray wells, the third belongs to Humble. One of Sunray's wells produces six gas zones in North LaWard field, Jackson County, and the other has five gas zones and one oil zone in McFaddin field, Victoria County.

Texaco's zones. Producing zones in the new Texaco well are: 7,020-26 ft. in the F-3 sand for oil, 8,113-19 ft. in the F-14-A for gas, 8,159-75 ft. in the F-15 for gas, 8,270-75 ft. in the Blessing sand for gas, 8,416-22 and 8,429-32 ft. in the Braden sand for gas, 8,480-82 ft. in the F-18 sand for oil, and 8,549-53 ft. in the F-19 sand for gas. Total daily potential for the two oil zones is 316 bbl. The F-3 sand flowed 169 bbl. of oil daily through 10/64-in. choke, and the F-18 sand got 147 bbl. per day on 12/64-in. choke.

Good dual producer completed in Texas' West Beaumont field

A good dual gas-condensate well was completed in West Beaumont field, Jefferson County, Texas Gulf Coast. It is Pan American Petroleum Corp. 21 Keith and Dowlen in the H. Williams League, A-56, 1 mile west of the city of Beaumont.

The well flowed 186 M.M.c.f.d. from Marginulina "C" perforations at 5,970-75 ft. Gravity of the condensate was 26.2°. Gas-liquid ratio is 47,200:1. The tubing completion was 28,600 M.c.f.d. plus 37.6°-gravity condensate. Gas-liquid ratio was 767,000:1. Perforations were in the Marginulina "D" zone at 6,072-77 ft.

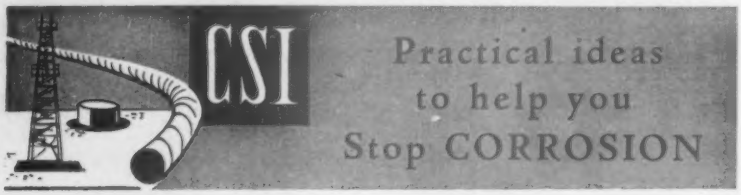
Brazoria County. Texas Eastern Transmission Corp. completed 1

North Rowan Gas unit 4 from Alvin sand perforations at 10,824-29 ft. flowing 22 M.M.c.f.d. Gas-liquid ratio is 88,800:1. This new well is location in the Francis Moore Survey, A-100.

South Texas. Harkins & Co. 1 J. W. Boothe is a new discovery in the east corner of DeWitt County, 12 miles southeast of Yoakum and 2 miles southwest of Brushy Creek field, nearest production.

The well flowed 1,800 M.c.f.d. from perforations at 7,806-14 ft. Gas-liquid ratio is 18,670:1, or 54 bbl. per million. Location is about 4 miles southwest of the Lavaca County line and about 4 miles northwest of the Victoria County line in the David H. Belfour Survey, A-74. Pay is Wilcox.

Also in DeWitt County, 2 miles northeast of Thompsonville in Amador field, Harkins & Co. et al. 4 Mary Atkinson is a shallow producer at 1,020-27 ft. Open flow was 1,650 M.c.f.d. This well, drilled to Wilcox at 8,168 ft., is the Refugio Amador Survey, A-1. It is the third producer in the shallow 1,000-ft. Miocene pay. The only other producer here is the 1 Atkinson Wilcox discovery well which found oil at 7,990-92 ft.



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Many corrosion engineers are concerned over the composition specifications of magnesium anodes used to stop corrosion on pipe lines, oil well casing, etc.—and rightly so. But there is a more important factor that is sometimes overlooked. This is the *actual weight* of the bare anode, particularly in backfill-packaged units.

During the past several years an increasing number of the companies that use anodes have found it pays to spot check the metal weight of all anodes purchased. Often the small cost of pulling the anode from the packaged backfill has been worthwhile. 17-pound anodes have been found to weigh as little as 14 pounds, 32-pound anodes from 26 to 30 pounds, and 50-pound anodes only 44 pounds.

We at CSI feel that, regardless of the supplier, a spot check should be made of all anodes purchased. Of equal importance, requests for quotations and the subsequent purchase orders should *define all specifications*. As far back as 1945, the industry set maximum weight deviations for bare magnesium anodes at ±3 per cent of the designated weight. We suggest that, if this condition is specified and checked, you will be getting more for your magnesium anode dollar.

You'll find it to your advantage to check with CSI for engineering and installation services, and for quality supplies for both anode and rectifier installations. Estimates or competitive quotations without obligation. Let our stock-holder-employees demonstrate the economical and satisfactory service they can give you. Call or write today.

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Deep wildcat slated for Waller County, Texas

A 20,500-ft. wildcat will be drilled in northwestern Waller County, 10 miles north of Hempstead, Tex. Shell Oil Co. will drill 1 G. A. Chapman 6 miles northwest of Clear Creek field. Location is in the Thomas Stevens Survey, A-57.

Duncan slough. Humble Oil & Refining Co. completed 5 J. C. Lewis as a dual oil producer in this Matagorda County field.

The well flowed 253 bbl. of oil daily from Frio-4 zone at 10,556-62 ft. through ⅛-in. choke. From Frio-5 perforations at 10,602-10 ft. the well made 283 bbl. of oil daily on ⅛-in. choke. Location is 3 miles southwest of Buckeye and 1,320 ft. north of the 1 Lewis oil discovery in the area. Spot is in the Christopher G. Cox Survey, A-18.

Polk County. James B. Fuller and associates completed 1 W. H. Kelly in Polk County flowing 31 M.M.c.f.d. from perforations at 5,031-33 ft. Location is 6 miles east of Segno in the Andrew Morales Survey, A-52.

Morrow production tapped at Texas Panhandle discovery

An upper Morrow Pennsylvanian sand discovery is reported in southeastern Ochiltree County, 16 miles southeast of Perryton in the Texas Panhandle. The well is Sinclair Oil & Gas Co. 1-B J. W. Daniel in Section 586, Block 43, H&TC Survey.

The well had a calculated absolute open flow potential of 5 M.M. c.f.d. from perforations in the upper Morrow at 9,182-9,200 ft.

Dual Pennsylvanian discovery completed in Wise County, Texas

A dual Pennsylvanian conglomerate oil discovery was completed 3½ miles northwest of Bridgeport in west-central Wise County, North Texas. The well is William L. Rodgers 1 Mrs. Lone Buckner Mc-

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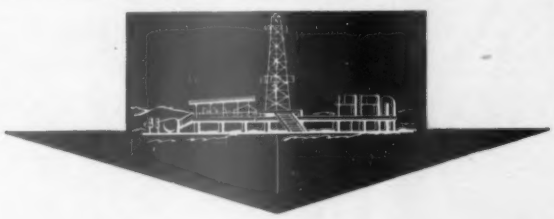

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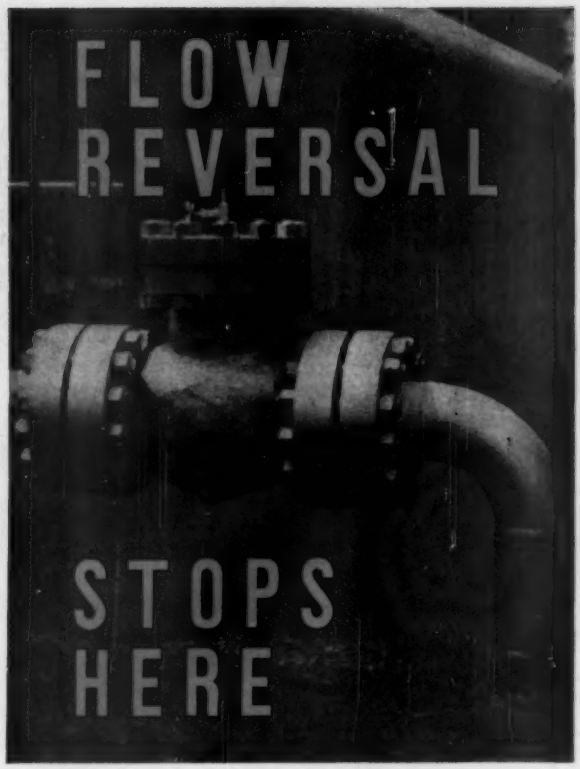

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Alister in the BBB&C Survey, A-114.

From 5,630-ft. Pennsylvanian conglomerate perforations at 5,224-33 ft. the well flowed 144 bbl. of oil on 12/64-in. choke. The lower zone at 5,660-ft. perforations, 5,639-48 ft., flowed 133 bbl. per day on 12/64-in. choke.

Young County. Sanford P. Fagadau 1 C. R. Funk, southeastern Young County, flowed 4,500 M.c.f.d. from perforations in the Strawn Pennsylvanian at 2,841-2,984 ft. through 20/64-in. choke. Location is in J. G. Oxford Survey, A-1503, 3½ miles southeast of Bunger.

Palo Pinto. Texaco Inc. completed 1 T. H. Hart "D" as an "A" zone conglomerate oil discovery inside an active gas area of northeastern Palo Pinto County.

The well flowed 368 bbl. of oil per day on 27/64-in. choke from perforations at 4,081-90 ft. The new field will be called Keechi Creek "A" Conglomerate field. Nearby production is in conglomerate gas sands. Location is in Section 1800, T&P Survey, 2 miles southeast of Graford.

Pipe being run at new Paradox basin discovery

Casing is being run at Lion Oil Co. 1 Clark in NW NE 28-38s-22e, new discovery north of Bluff Bench field in San Juan County, Paradox basin, Utah. The well flowed 20-30 bbl. of oil per hour on drill-stem test of Ismay Pennsylvanian.

Also in San Juan, Bill Stricklin is swabbing at 1 Norma-Federal in C SW NW 33-39s-18e.

Data released on Texas offshore gas discovery

Shell Oil Co. has released first data on its 1 Federal Block 160 gas discovery offshore from Galveston County, Texas.

The well flowed 4 M.M.c.f.d. on initial gage plus 5 bbl. condensate and 35 bbl. water per million from perforations at 8,444-69 ft. Tubing pressure was 2,940 psi. Operators took the wildcat to 12,889 ft. It is 30 miles east of Galveston on a 5,760-acre Gulf of Mexico Tract 160.

Frio discovery completed in Hidalgo County, Texas

First deep production in South Monte Christo field in Hidalgo County, South Texas, is reported 10 miles northwest of Mission at Texkan Oil Co. et al. 1 Yturria Land & Cattle Co.

The well flowed 46 M.M.c.f.d. plus condensate at the ratio of 24,500:1, 41 bbl. to the million, from perforations in the Frio-Vicksburg at 10,518-28 and 10,534-50 ft. This well is a southeast extension of

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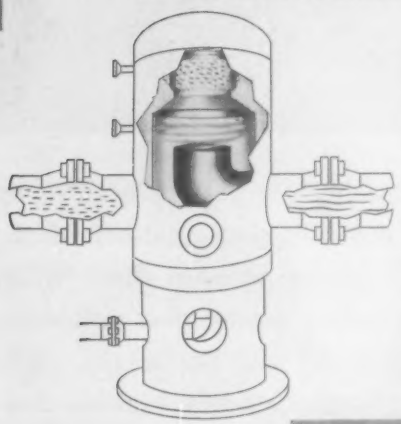

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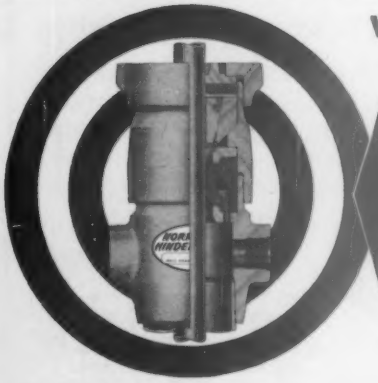

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TUBING CASING HEADS

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the field and a new-pay discovery. There are three wells in the field, producing from Mission and Heard sands at 7,662 to 8,450 ft. Location is 660 ft. from northeast and 2,763 ft. from northwest lines of Porcion 48.

Pennsylvanian gas discovery completed in West Texas

A recently opened Clearfork oil area in Halley field, Winkler County, West Texas, now has Pennsylvanian gas production. The new dual producer is Sinclair Oil & Gas Co. 11 Sealy & Smith unit.

The well had a calculated absolute open flow potential of 2,300 M.c.f.d. from perforations at 8,042-8,116 ft. Previously, it flowed 212 bbl. of 39.5°-gravity oil daily through Clearfork perforations at 5,251-61 ft. Location is 12 miles north of Monahans in Section 71, Block A, G&MMB&A Survey.

South Corn pool in Central Oklahoma extended to north

Cleveland County's South Corn field, Central Oklahoma, gained a good north extension discovery. It is Monsanto Co. 1 Polk in SE SE SE 11-9n-3w.

The well flowed 30 bbl. of oil per hour on a 5-hour test from perforations in the Bromide Ordovician sand at 9,618-35 ft. Flow was through ¼-in. choke. Location was staked for another well at 2 Polk in SW NE SE 11. It will drill to 9,750 ft.

Grady County. Cleary Petroleum Corp. has a third well in Northwest Blanchard field, Grady County.

The 3 Hilltop in C NE SW 8-8n-5w flowed 2,060 M.c.f.d. and recovery was 1,485 ft. of condensate on drill-stem test at 11,808-11,893 ft.

Arkoma nets significant find

Southeastern Oklahoma's Arkoma basin got one of its most important discoveries yet at Apache Corp. 1 Etchison unit, SE SW NE 4-7n-18e, ½ mile north of shallow Carney gas field in northeastern Pittsburg County.

The well flowed 4,700 M.c.f.d. through open choke from perforations in the Atoka basal Pennsylvanian at 6,184-6,212 ft. Nearest Atoka gas is about 8 miles east and northeast. This Atoka discovery could extend the trend well to the west of current development.

Deep wildcat slated for Arkoma's Savanna anticline

An old 7,058-ft. wildcat on the Savanna anticline near the town of Savanna in Pittsburg County, southeastern Oklahoma, will be reentered by Phillips Petroleum Co.

Phillips will take the 1 Mullins to 12,000 ft. or Ordovician. Location is in SE SW 29-4n-14e.

Discovery wells

INDIANA

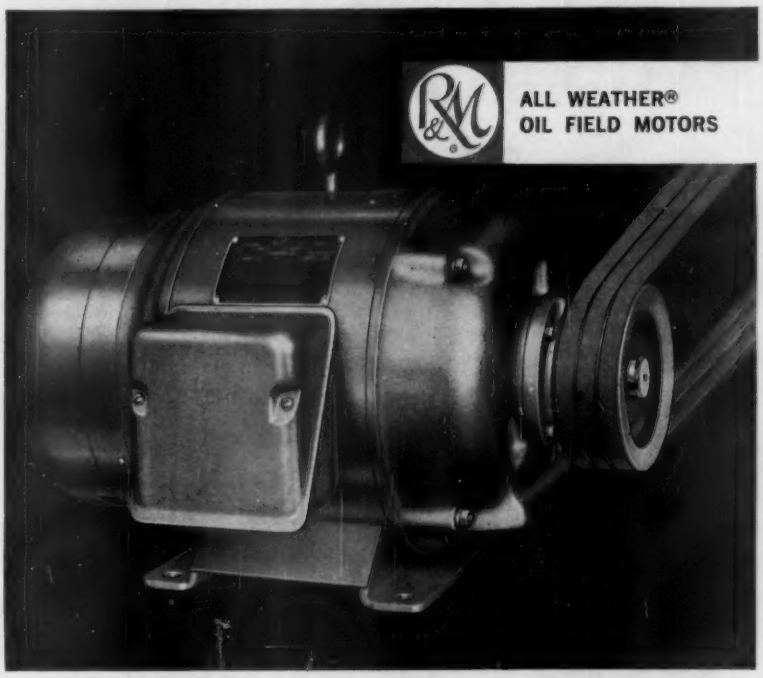
Jefferson County:
Prentice Mikesell 1 Wm. Copeland, NW SW SW 33-4n-11e. IPF 48,000 M.c.f.d., Trenton. TD 490 ft. Opens Pleasant Ridge field.

KANSAS

Anderson County:
R. H. Siegfried 1 Anderson estate, SE SE NW 31-19s-20e. IPF 225 M.c.f.d., Squirrel sand open hole 750-925 ft. TD 925 ft. New gas discovery in eastern Kansas.

Decatur County:
Empire Drilling Co. 1 Katha, C SE NE 7-1s-28w. IPF 43 BOPD, Lansing 3,606-18 ft. TD 4,096 ft. New oil discovery.

Grant County:
United Producing Co. Inc. 2 McCabe



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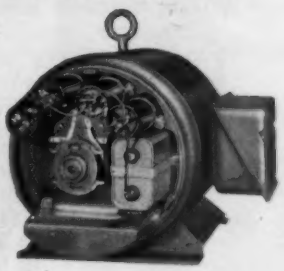

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unit. C SE NE 3-30s-35w. IPP 120 BOPD, swab, Marmaton 4,600-4,701 ft.; IPP 190 BOPD, swab, Morrow 5,341-47, 5,354-70, 5,212-17 ft. TD 5,882 ft. New dual oil discovery.

Osage County:

Messman-Rinehart Oil Co. 1 Woodward, NW NE NW 23-16s-16e. IPP 25 BOPD, Mississippian 1,546-64 ft. TD 1,617 ft. New oil discovery.

MICHIGAN

Lenawee County:

McClure, Good and Gray 1 Preston, SE NW SE 23-5s-5e, 5 miles north of Deerfield pool. FAIP 12 BOPD, Trenton dolomite 2,548-2,640 ft. TD 3,305. New oil discovery.

St. Clair County:

I. W. Hartman and McClure Oil Co. 1 Douglass, NW SE NE 15-4n-16e, China Twp., 6 miles east Peters field. NIP 450 M.c.f. gas, Niagaran dolomite. TD 2,607 ft. New gas discovery.

Frank Stratton 1 Babel, NE NW SE 33-4n-16e, China Twp., 3 miles south China-Bell River gas field. FAIP 750 M.c.f. gas. Niagaran reef, pay 2,324-26 ft. TD 2,743 ft. New gas discovery.

NEBRASKA

Dundy County:

Sunray Mid-Continent Oil Co. 1 Shafer, C SE NW 31-3n-37w. IPP 35 BOPD, Lansing-Kansas City 4,348-4,442 ft. TD 4,561 ft. Lansing-Kansas City discovery, new field.

Kimball County:

Juniper Oil & Mining Co. 1 Robinson, C NE SE 6-15n-55w. IPP 102 BOPD, 25 BWPD, "J" sand 6,449-55 ft. TD 6,502 ft. New "J" sand oil discovery, new field.

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Red Willow County, Midway:

K&E Drilling Co. 1 Boyd, C NW NW 23-1n-27w. IPP 110 BOPD, Lansing-Kansas City 3,214-26 ft. TD 3,534 ft. New oil discovery.

Red Willow County, Silver Creek:

Burch Drilling Co. 1 Haag, C NW NW 19-2n-26w. IPP 210 BOPD, some water, Cherokee 3,520-49 ft. TD 3,570 ft. Cherokee discovery, new pay.

OHIO

Hocking County:

James R. Swingle 1 J. B. Wagoner, Sec. 22, Falls Twp. IP 5 BOPD, 94 M.c.f.d., Clinton 2,715-40 ft. TD 2,750 ft.

OKLAHOMA

Nowata County:

Jack Harden 1 Shipley, SE NE NW 24-28n-17e. IPF 505 M.c.f.d., Burgess 806-9 ft. TD 821 ft. New gas discovery.

Rogers County:

John C. Hunendaal 1 R. T. Johnson, SE SE NW 1-22n-17e. IPP 4 BOPD, no water, 36.2°, Burgess open hole 653-78 ft. TD 678 ft. New oil discovery.

SOUTH TEXAS

Bee County:

Pawnee area. Shell Oil Co. 1 Alvin L. O'Neal, 3 miles south of Pawnee in Sec. 30, Theodore Plummer Subd. of Lott Lands. IPAOF 7,800 M.c.f.d., SITP 4,434 psi., BHPSI 5,684 psi., dry gas, Edwards lime 13,671-13,873 ft. TD 17,004 ft. New gas discovery.

Hidalgo County:

South Monte Christo: Texkan Oil Co. et al. 1 Yturria Land & Cattle Co., 9 miles northwest of Mission in Porcion 48. IPAOF 46 M.M.c.f.d., SITP 6,110 psi., GLR 24,500:1, 39.6°, BHPSI 7,356 psi., Frio-Vicksburg 10,518-28 and 10,534-50 ft. TD 12,021 ft. New gas-condensate discovery.

Williamson County:

Thrall area. T. M. Murchison 1 W. C. Brookshire, 8 miles east of Granger in Pedro Garza Grant. IPP 3 BOPD, no water, 31°, Buda lime 1,040-44 ft. TD 1,198 ft. New oil discovery.

SOUTHWEST TEXAS

DeWitt County:

DeLange, Neathery, Schimmel 1 Jessie M. Houchine, 3 miles southeast of Yorktown in M. Fox Sur., A-191. IPAOF 3,700 M.c.f.d., SICP 1942 psi., 58°, GLR, 42,000:1, BHPSI, 3,112 psi. Wilcox 7,231-43 ft. TD 7,689 ft. New gas-condensate discovery.

Henze field. Skelly Oil Co. 1 Jimmie Speed, 5 miles south of Yorktown, Jose Santos Sur., A-420, IPAOF 2,600 M.c.f.d., SITP 7,326 psi., 56.4°, GRL 31,600:1, BHPSI 8,938 psi., Wilcox 11,291-11,310 ft. TD 12,002 ft. New gas-condensate discovery.

TEXAS GULF COAST

Polk County:

James B. Fuller & Associates 1 W. H. Kelly, 6 miles east of Segno in Andrew Morales Sur., A-52. IPF 30 M.M.c.f.d. Yegua 5,000-ft. sand 5,031-33 ft. TP 1,700 psi., SITP 1,744 psi., BHPSI 3,881 psi. TD 8,225 ft. New gas discovery.

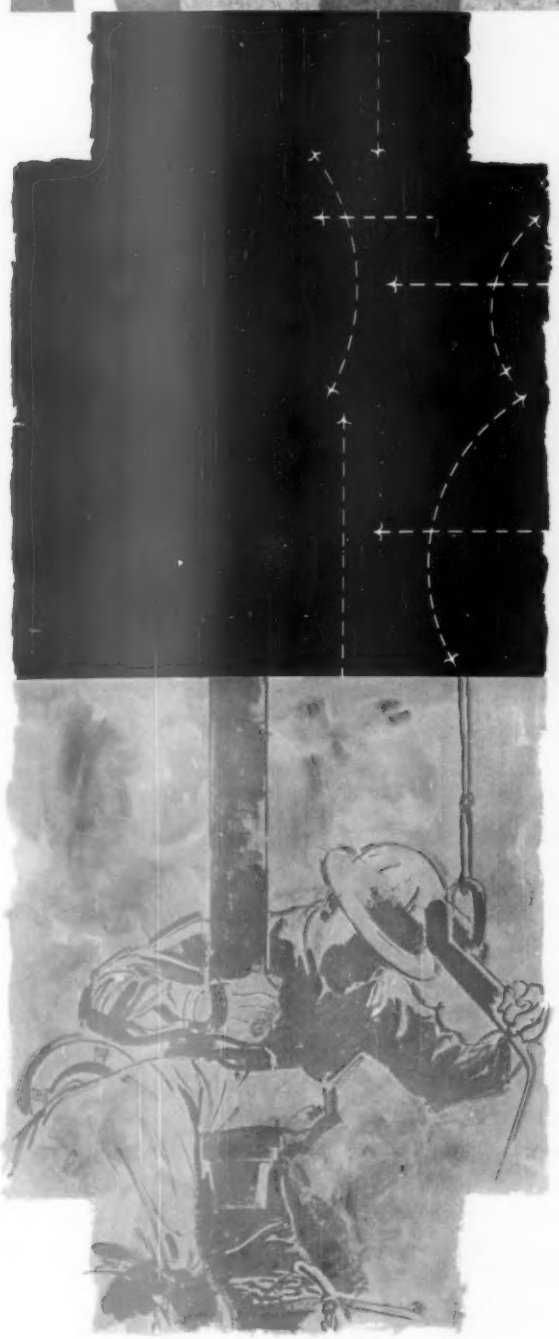
TEXAS PANHANDLE

Hemphill County:

Alexander Morrow field. Shell Oil Co. 1-68 Fred Hobart Ranch, 12 miles south of Canadian in Sec. 68, Blk. A-2, H&GN Sur. IPAOF 6,500 M.c.f.d., Morrow 13,154-81 ft., SIP 5,385 psi. TD 15,209 ft. New gas discovery.

Shell Oil Co. 1 Fred Hobart Ranch "A,"

REED



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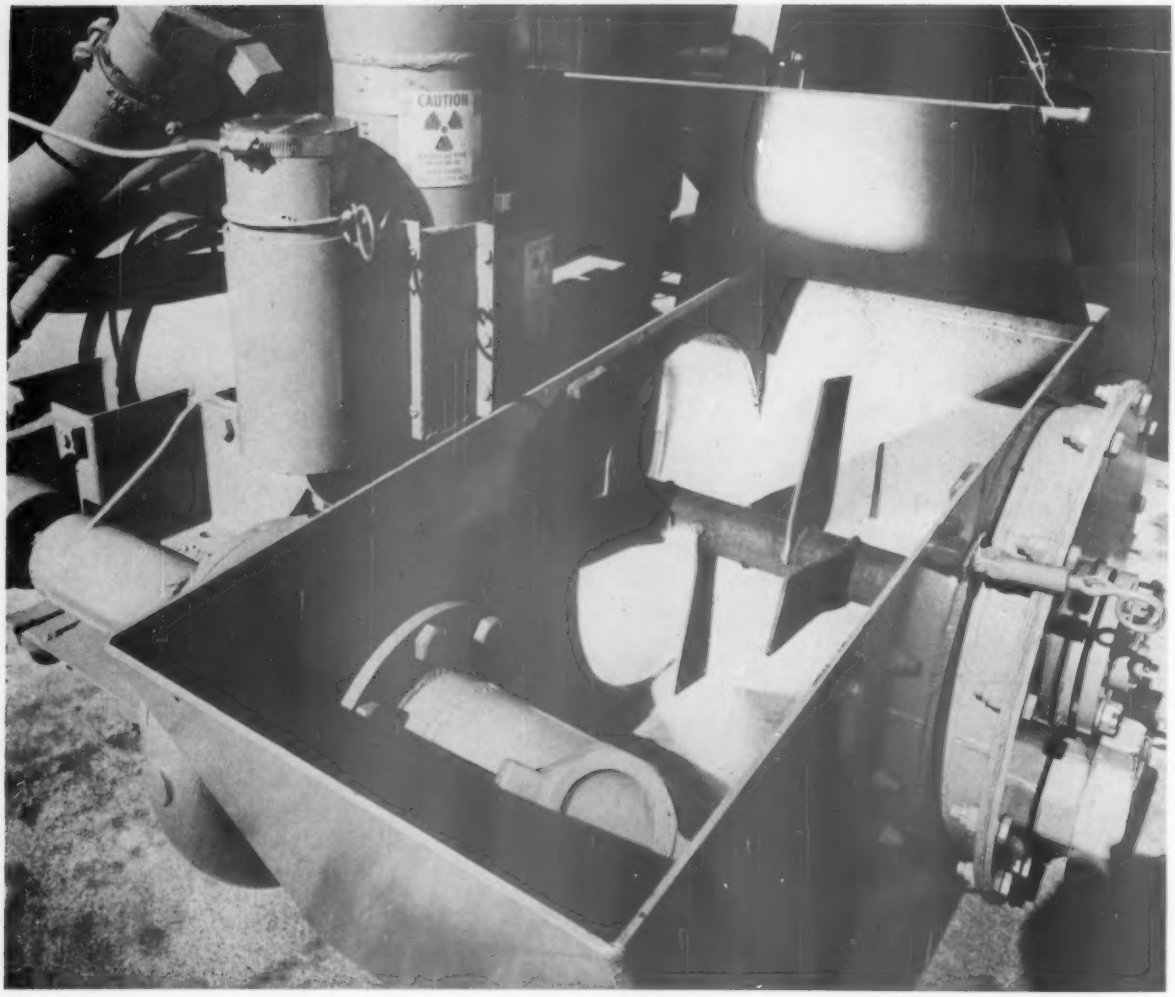

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68-A2-H&GN Sur. IPF 6,500 M.c.f.d., Morrow sand 13,154-81 ft. TD 15,219 ft. New Morrow gas discovery.

Hutchinson County:

Horizon Oil & Gas Co. et al. 1 Harvey "DD," 41-46-H&TC Sur. IP 25 BOPD, 19 BWPD, 36.4°, granite wash 6,408-16 ft. TD 8,500 ft. New oil discovery.

WEST CENTRAL TEXAS

Coleman County:

Haynes B. Ownby Drilling Co. 3 M. L. Stone, OWWO, 3½ miles north of Talpa in Dugold McLean Sur. 757. IPF 32 BOPD, 16/64-in. choke, 41.4°, GOR 750:1, CP packer, TP 130 psi., Palo Pinto 3,252-82 ft. TD 3,738 ft. PB 3,543 ft. New oil discovery.

W. B. Fultz & David A. McMahon 2 J. B. McCord, 4 miles west of Valera in John R. Jackson Sur., 30. IPCAOF 6,600 M.c.f.d., Gardner sand 3,248-63 ft. TD 3,271 ft. New gas discovery.

Palo Pinto County:

E. L. Wilson 1 T. A. Haynes, 4 miles northwest of Mineral Wells in Sec. 60, Blk. A, T&P Sur. IPCAOF 39 M.M.c.f.d., GOR 121,000:1, 63.4°, Marble Falls conglomerate 4,219-38 ft. TD 4,430 ft. New gas-condensate discovery.

Shackleford County:

Dorothy Sue Miss. field. Bond Oil Corp. 2 P. W. Pitzer, 12 miles northeast of Albany in Sec. 395, TE&I Sur. IPF 850 BOPD, Miss. lime 4,578-4,600 ft. TD 4,639 ft. PB 4,600 ft. New oil discovery.

Taylor County:

Wildcat in Regular field. H. M. Cogle 1 Hafner, 3 miles east of Tuscola in Luke Bryan Sur., 409. IPP 86 BOPD, 40°, GOR 467:1, McMillan sand 2,792-97 ft. TD 2,844 ft. New oil discovery.

WEST TEXAS

Crane County:

Ray Morris Exploration Co. et al. 1 T. C. Barnsley, 16 miles west of Crane in Sec. 27, Blk. B-27, PSL Sur. IPCAOF 650 M.c.f.d., Wolfcamp Permian 5,435-5,537 ft. New gas discovery. TD 5,824 ft.

2 T. C. Barnsley, Sec. 27, Blk. B-27, PSL Sur. IPCAOF 7,100 M.c.f.d., Clearfork 3,841-66 ft. TD 4,217 ft. Clearfork discovery in above new field.

Bayview Oil Corp. 1-B A. R. Eppenauer, 4 miles southwest of Crane in Sec. 7, Blk. 6, H&TC Sur. IPF 168 BOPD, 12/64-in. choke 42.7°, GOR 528:1, TP 270 psi., packer, San Andres 2,066-88 ft.; IPF 395 BOPD, 16/64-in. choke, 42.7°, GOR 992:1, TP 500 psi., packer, Glorieta 3,019-32 ft. TD 3,062 ft. Dual oil discovery.

Gulf Oil Corp. 2-A C. W. Edwards et al., 25 miles northwest of Crane in Sec. 6, Blk. B-21, PSL Sur. IPF 160 BOPD, 12/64-in. choke, 37.8°, GOR 687:1, TP 375 psi., CP 575 psi., McKee casing notch 6,179 ft. TD 6,220 ft. New oil discovery.

LEGAL

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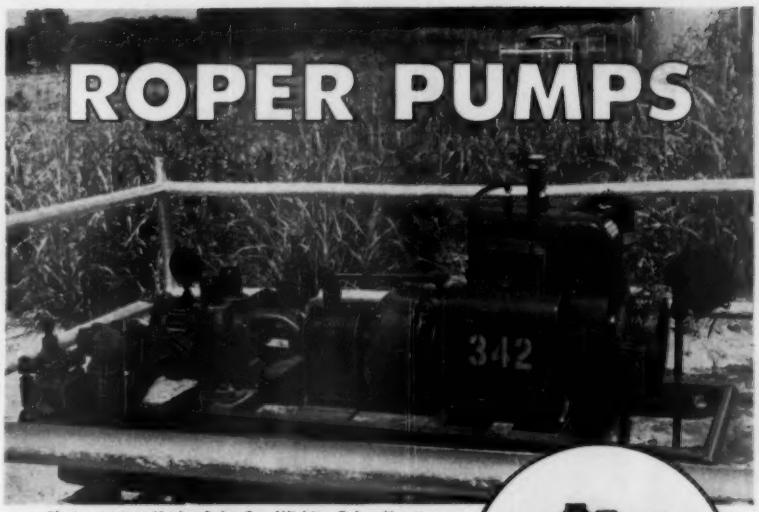
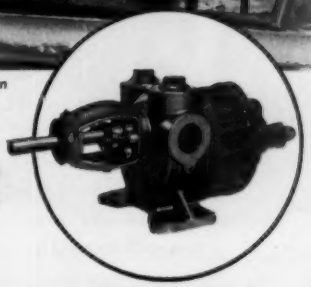


Photo courtesy Harley Sales Co., Wichita, Tulsa, Houston



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James McDonald . . . he helped plan Delaware plant.

Refiner Turns Administrator

• James McDonald moves another step beyond his specialty to become Tidewater vice president and division manager.

UNTIL 2 years ago, James McDonald, Tidewater Oil Co.'s new vice president and western division general manager, was strictly a refining man. Today he's running a division which covers all phases of the business.

McDonald's ability to learn about oil operations outside the refining field is characteristic of his 21-year career with Tidewater.

He started learning things outside his sphere of operations almost from the day he joined the company as a junior process engineer at the old Bayonne, N. J., refinery in 1940.

"I felt I had to know the whole refinery or I didn't know my job," he says.

Working at Bayonne during the war years gave him opportunity to learn more than one phase of refining. The plant produced the full range of products, including wax and lubes. Before he left Bayonne in 1954, after working up to assistant process superintendent, McDonald had spent time in every area of the refinery's operations.

Often he was cast as a coordinator for various parts of the plant. This found him crossing from one segment of the refinery to another in order to get people to work out their problems together.

He feels the lack of desire to look outside their specific realm of interest is one thing which hampers young engineers in their growth within a company nowadays.

"Too many times a young engineer says something is not in his department. A secondary outgrowth of this attitude is that he doesn't care about the other guy's problem."

Bayonne was McDonald's introduction to the oil business. He had applied for a job as a technician in the refinery's automotive laboratory, but when the refinery management saw his Yale University record that included a degree in mechanical engineering, they immediately moved him into processing.

McDonald took courses in chemical engineering at the Polytechnic Institute of Brooklyn to better qualify himself for his new job and also enrolled in the refinery's school, which met for 1½ hours after work twice a week. He did so well in the latter that he was made instructor the following year when the regular instructor left the company.

He taught in the refinery school at Bayonne until he left the plant in 1954.

Helped plan Delaware . . . When Tidewater decided to build its 150,000-bbl. Delaware City refinery, McDonald was picked as one of a six-man task force to serve as coordinators with the contractors in planning the big plant.

He worked as a member of the "new refinery advisory group" for 2½ years.

▶▶▶ Personals

Kenneth E. Francis, geophysicist with Texaco, has been transferred from Liberal, Kans., to Oklahoma City.

H. D. Galloway, recently elected a director of A/S Esso Raffineriet Norge, Norwegian refining affiliate of Standard Oil Co. (N. J.), has been named chairman of the company. He will continue as vice chairman and a director of A/S Norske Esso, Jersey's Norwegian marketing company.

G. W. Crickmay, vice president and general manager of Venezuelan Atlantic Refining Co., Caracas, will become manager of Atlantic Refining's new western Canada region in October. He will headquarter in Calgary. **Richard Chadwick-Collins,** assistant manager of the Venezuelan company, will succeed Crickmay in Caracas.

J. G. Gerescher, petroleum engineer with Venezuelan-Sun Oil Co. in Maracaibo, Venezuela, has been transferred to Mount Pleasant, Mich., as petroleum engineer for Sun Oil Co.

M. Dean Kleinkopf, lead geophysicist for California Oil Co. in Salt Lake City, has been promoted to lead geophysicist in Denver. He will be in charge of gravity and magnetic interpretation and operations in the Rocky Mountain area.

When the plant went on stream, he served as assistant manager. He moved west to Tidewater's headquarters, then in San Francisco, in 1957 and became manager of manufacturing.

He took his first assignment outside the refining field in July 1959 when he became assistant general manager of the western division, now with the headquarters in Los Angeles.

Early years . . . There was nothing in McDonald's early years to indicate he would ever become an oil company executive.

He was born far from the oil patch in Coney Island Hospital in Brooklyn. He calls Hohokus, N. J., home, but graduated from high school at nearby Ridgeway, N. J.

McDonald was only 20 when he graduated from Yale in 1937, so he decided he had a couple of years to spend helping his family develop a marionette show before starting out as an engineer. In his time with the marionette show, he did everything from manipulating the strings to cleaning up the stage.

During 3 years in show business, McDonald appeared at the 1939 World's Fair in New York and on some of the early television shows. The war and gasoline rationing put an end to traveling on the vaudeville circuit, and in 1940 McDonald decided it was time to start an engineering career.

He didn't pick the oil industry for any particular reason, but merely applied for the lab technician's job with Tidewater and took what the company had to offer. However, his engineering ability and desire to learn decided his future, which today means managing a growing division of a growing oil company.

James E. Ivins, E. L. Capps, and **E. R. Karter** have been named vice presidents of Tenneco Corp. **R. E. McGee,** Tenneco treasurer, has been elected vice president and treasurer.

Philip S. Justice, special assistant to Sun Oil Co.'s senior vice president in charge of production, has retired after 41 years with the company. Justice was manager of the Rocky Mountain division before being named special assistant to the senior vice president last year.

Coyle E. Singletary, geologist with Union Oil Co., has been transferred from Roswell, N. M., to Tulsa.

Don M. Simecheck has been named sales vice president for Fish Engineering Corp.

William B. Ross has joined American Oil Co.'s Whiting, Ind., research laboratories as technical-computing specialist.

Donald W. Wiger, formerly district geologist in Casper, Wyo., for Sinclair Oil & Gas Co. has opened consulting offices in Casper.

R. M. Armstrong has been named Houston area crude-oil representative for Shell Oil Co. **R. E. Dobyns** has been named crude-oil supervisor in the Houston transportation and supplies office.

Tom Rovello, Jr., district petroleum engineer for Venezuelan Atlantic Refining Co. in Oritupano, Venezuela, has been promoted to operations representative for Lake Maracaibo.

Kenneth D. McPeters, production superintendent with **John M. Kelly** since 1955, has opened offices as petroleum consultant in Hobbs, N. M. Kelly, now assistant secretary of Interior, divested himself of oil interests when he took the federal post earlier this year.

John E. Maybin has been promoted to manager of engineering for Canadian Western Natural Gas Co. and Northwestern Utilities, Ltd. He will be responsible for long-range engineering planning, gas-supply policies and contract negotiations.

Warren J. Miller, Superior Oil Co., Houston, has been elected president of International Oil Scouts Association. Other new officers include **Harlan Washington,** Ohio Oil Co., Jackson, Miss., first vice president; **George B. Ross,** Humble Oil & Refining Co., Midland, Tex., second vice president; **Jack Orman,** Plymouth Oil Co., Calgary, third vice president; **Barney Bernard,** Richfield Oil Corp., Los Angeles, secretary-treasurer; and **Don Nicholas,** Phillips Petroleum Co., editor-in-chief.

▶▶▶ Personals

A. S. C. Hulton, a director of Shell International Petroleum Co. and coordinator for Africa and the Middle East, has been elected president and a director of Asiatic Petroleum Corp. He succeeds **David**

HULTON

WALSTROM

H. Barran, recently named a managing director of the Royal Dutch-Shell group in London. Hulton also has been appointed a director and chairman of the executive committee of Shell Caribbean Petroleum Co. **John A. Walstrom** has been elected to succeed Barran as president of Shell Caribbean Petroleum. Walstrom has been a vice president of Shell Caribbean since 1953, and a director since 1957. He is also vice president and a director of Asiatic and will continue in these posts. **J. H. French,** treasurer and a director of Shell Caribbean, has been named a vice president, succeeding Walstrom.

Dr. Allen E. Leybourne III has joined the development section of American Oil Co.'s research and development department, Texas City.

Morris W. Leighton, section head in geological research for Jersey Production Research Co. in Tulsa, has been given a 1-year special assignment for the company in Geneva, Switzerland.

J. E. McCleary has been named head of crude-oil contracts and negotiations in Humble's supply and transportation department. **A. J. Ferguson** has been named coordinator of planning, evaluations, and forecasts for the crude-oil section of the department. Also, **G. W. LeVan** has been named head of the division-order group, and **Joe C. Delaney** has been named head of the crude-oil evaluation section, supply and transportation.

Personals

Howard H. Belew, Skelly Oil Co. special assistant to the vice president, has been named general manager of the manufacturing department. **J. W. Vaiden,** senior vice

BELEW

BYARS

president in charge of manufacturing and a director of Skelly, will retire February 1 after 37 years with the company. Vaiden will serve in an advisory capacity until his retirement. **L. L. Byars,** head of gas operations, has been named manager of a new gas department. He will be responsible for gas purchases and sales and coordination of other gas transactions. In other changes, **John A. Craig** has been named manager of natural-gasoline plants. **J. Y. Haslam** has been named manager of technical services, and **Wesley H. Baker** has been named assistant to Belew in charge of liaison between manufacturing and marketing departments.

Pipeline contractors serving the gas-distribution industry have held preliminary meetings leading to formation of a new trade association. **E. H. Clark**, Engineering-Construction Co., Tulsa, has been named chairman of the organization committee. **W. C. Donaldson,** Underground Contractors, Inc., and **Arthur Everham,** Midwestern Contractors, Inc., will serve as committee members. Final organization meeting will be held this month in Kansas City.

Austen Hargrave, assistant manager of Lone Star Gas Co.'s gas-supply department, exploration and gas-supply division, has been named manager of the department.

Gail G. Fleming, development foreman for Humble in Billings, Mont., has been promoted to production foreman in Seminole, Okla.

Stan T. Sawabini has joined Signal Drilling & Exploration, Inc., as drilling engineer trainee in Baker, Mont.

William P. Conway, Plymouth Oil Co. administrative assistant, has been named assistant to the president, a new position.

Paul Fly and **Bernard Shrider** have joined Ashland Oil & Refining Co. in Henderson, Ky., as petroleum engineers.

George M. Bickel, assistant division manager in Denver for Texaco, has been named division sales manager there. He succeeds **Walter B. Gilbert,** recently named general sales manager in the southern region, Houston.

S. A. Ballard has been named manager of research and development in Shell Chemical Co.'s industrial-chemicals division. Ballard has been on foreign assignment with Bataafse Internationale Chemie Mij. He is a former director of chemical research at Shell Development Co.'s Emeryville, Calif., research center.

Vern Lewis will become manager of Skelly Oil Co.'s lubricating division September 1. He will succeed **Clarence E. Gore,** who will retire August 31 after 42 years with the company and its predecessors. **Paul Bartholow** will be first assistant in the lubricating division.

Three citations for service will be presented during the eastern district meeting of API's Division of Production next week in White Sulphur Springs, W. Va. Receiving the citations will be **James M. Bird,** Birdwell division of Seismograph Service Corp., Tulsa; **N. C. Ludwig,** Universal Atlas Cement Co., Gary, Ind.; and **H. J. Magner,** Delta Drilling Co., Pittsburgh.

John M. Robinson, former vice president and a director of Macco Corp. in charge of the oil-field divisions, has been named western sales manager for Houston Chemical Co. He will headquarter in Los Angeles.

Alvin J. Raschke, engineer with Rice Engineering Co. in Hobbs, N. M., has joined MacDonald Oil Corp. in Midland, Tex., as engineer.

Gulf Oil Corp. has formed three new departments—petrochemicals, product-supply, and refining—in a realignment of manufacturing operations. **Dr. Alexander Lewis, Jr.,** a vice president, will head the petrochemicals department and will be a member of Gulf's administrative committee. **K. S. Manning,** coordinator, will be responsible for world-wide product-supply coordin-

LEWIS

MANNING

COTTON

ation. He will be chairman of the product-supply council and a member of the administrative committee. **Ernest Cotton,** coordinator, will be responsible for coordination of world-wide refining operations. He will be chairman of the refining council and a member of the administrative committee. In product supply, **J. N. McGarvey** has been named manager of operations in the United States. **R. P. Hooper,** Gulf Eastern Co., will handle product-supply operations in the Eastern Hemisphere from his headquarters in London. **G. J. Benjamin,** man-

Deaths

William F. Stotz, 63, general attorney for Atlantic Refining Co., died July 3 in a Philadelphia hospital. Stotz had been with Atlantic since 1922.

M. E. Worsley, 72, Midland, Mich., independent operator, died June 26 after a heart attack at his Midland home.

Leslie T. Fournier, 59, vice president and treasurer of Panhandle Eastern Pipe Line Co., died July 5 at his home in Ridgewood, N. J., after a heart attack. Fournier joined Panhandle Eastern in 1946 as vice president in charge of economics.

ager of product trading, will be responsible for Western Hemisphere disposition of residual fuel oil and for cargo sales and purchases needed to balance the product-supply program. He will headquarter in New York. In refining, **B. H. Barnes,** a Gulf vice president, will be responsible for U. S. refining operations. He will headquarter in Houston. **C. D. Read,** vice president of Gulf Eastern Co. in London, will be responsible for Eastern Hemisphere refining.

James G. Dodd, Houston consultant, has joined Oliver & West, Inc., consultants, as head of the company's Houston office.

Il C. Choi has joined the staff of American Oil Co.'s Whiting, Ind., research laboratories. He will work with design of processing equipment.

James H. Hafenbrack, assistant to Humble's Billings, Mont., area geologist, has been promoted to assistant to the Denver area geologist.

Frans H. Hammons, staff geophysicist with Pan American Petroleum Corp., has been transferred to New Orleans, from Lafayette, La.

George T. Higginbotham, district engineer in McAllen, Tex., for Delhi-Taylor Oil Corp., has been promoted to district superintendent in Farmington, N. M.

Norris J. Dupré, senior pusher with Shell de Venezuela in Maracaibo, Venezuela, has joined Delta Drilling Co. in Houma, La., as tool pusher.

Harry Holtom, geologist with British-American Oil Producing Co. in Denver, has been transferred to McCook, Neb., in the same capacity.

F. Wilson Hood, geologist with Ohio Oil Co. in Lafayette, La., has joined Hope Natural Gas Co. in New Orleans as geologist.

R. L. Trott, executive assistant to the vice president in Shell Oil Co.'s Houston area, has retired after 33 years with the company.

Richard M. McGowen, assistant comptroller of Pan American Petroleum Corp. in Tulsa, will become comptroller of Standard Oil Co. (Ind.), the parent company, September 11. He will succeed **William A. Underwood,** who is leaving the company for health reasons.

James C. Egan, Pure Oil Co.'s marketing assistant to the northern regional general manager, has been promoted to southeastern division sales manager in Atlanta, Ga. **H. L. Fowler,** marketing assistant for the midwestern division, has moved to the northwestern division in the same capacity. **Ralph S. Townsend,** Kalamazoo, Mich., district manager, has been named marketing assistant for the central and midwestern divisions.

▶▶▶ Personals

J. D. Goodrich, production manager for Shell Oil Co.'s Denver exploration and production area, has been transferred to Houston as director of production research for Shell Development Co.'s exploration and production research division. **Powell Dennie** will succeed Goodrich in Denver. Dennie has been assistant to the vice president of Shell's Pacific Coast area in Los Angeles for the past year. He was division production manager in Roswell, N. M., before that time. Goodrich has been with Shell since 1937. He had been North Texas division production manager and manager of the head office mechanical-engineering department before taking the Denver area post in 1957.

GOODRICH

DENNIE

John B. Mackenzie, Jr., has been named marketing coordinator, plastics, for Enjay Chemical Co. He succeeds **Carl Virgin,** who will coordinate introduction and marketing of new plastic products and their applications.

He was named treasurer in 1950. He was also vice president and treasurer of Trunkline Gas Co., a subsidiary, and a director of Hugoton Production Co., Northern Ontario Natural Gas Co., and National Distillers & Chemical Corp. He was a former Princeton faculty member and had been with the U. S. Securities and Exchange Commission.

James Ryan Walker, 53, staff geophysicist for Murphy Corp. since 1958, died July 6 in an El Dorado, Ark., hospital after a brief illness.

Joseph S. Bottler, 66, general adjuster for General Adjustment Bureau, Inc., died July 9 in a Tulsa hospital. Bottler was well known in the industry for his adjustment of refinery losses in the United States and several foreign countries.

Morris H. Wallace, 43, Muskogee, Okla., consulting geologist, died July 9 in a Muskogee hospital. Wallace was instructor in geology at the University of Tulsa before opening consulting offices last year.

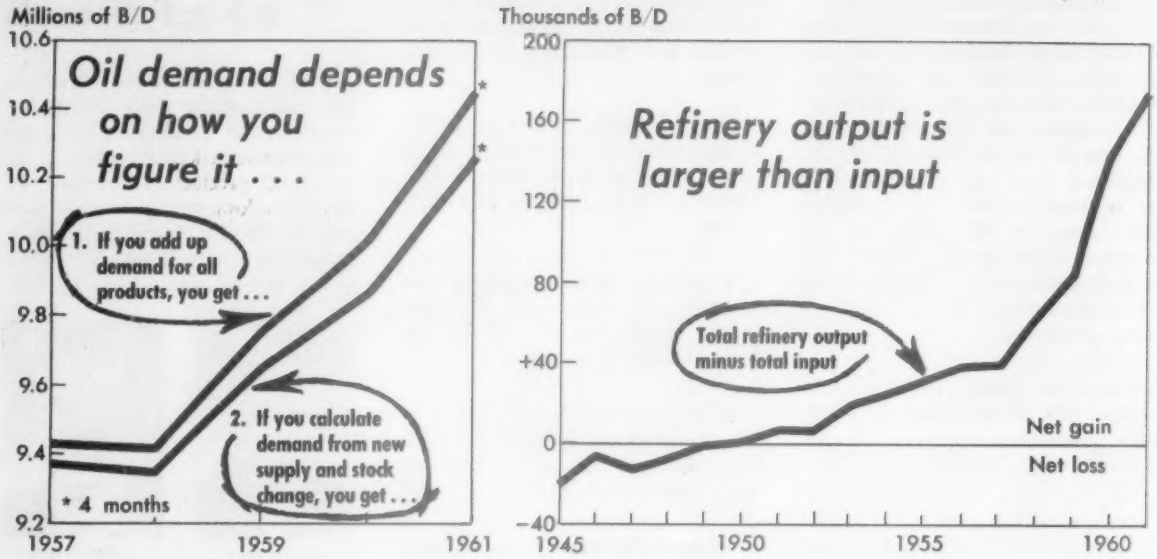
Elster A. Smith, manager of Lone Star Gas Co.'s gas-supply department, exploration and gas-supply division, died June 26 in a Dallas hospital.

E. J. McLain, 65, who recently retired as assistant to the vice president of Shell Oil Co.'s New Orleans area, died July 10. McLain and his wife apparently suffocated when fire broke out in their New Orleans apartment.

John K. Carrabina, 53, supervisor of Humble's plans and records section in Tulsa, died July 9 at his home in Tulsa after a heart attack. Carrabina had been with Humble for 25 years.

Marion Ellis Fry, 73, Cisco, Tex., oil operator, died July 6 in a Cisco hospital.

Irving R. Funk, 59, Richfield Oil Corp. production superintendent, died July 4 at his home in Long Beach, Calif.



The whole isn't equal to its parts

BY JOHN C. CASPER

TOTAL 1960 DEMAND for petroleum and products averaged 9,879,000 bbl. daily, according to the December Monthly Petroleum Statement of the Bureau of Mines. This is a calculated average, based on total new supply and stock change.

Here are the factors. Crude production averaged 7,035,300 bbl. daily. Gas-liquids production plus a little blending material from outside the industry amounted to 942,100 bbl. daily. Total production was 7,977,400 bbl. daily.

Crude and product imports averaged 1,818,700 bbl. daily to bring total new supply to 9,796,100 bbl. daily.

Operators and refiners drew from storage more than they put in for a net withdrawal of 82,600 bbl. daily.

New supply plus withdrawals averaged 9,878,700 bbl. daily, and that is the total reported for the year by the Bureau of Mines. This calculation has been the accepted method for estimating demand.

It worked all right until refiners began making more products than the total of raw materials used. The first overage showed up in 1950, but the total was small, amounting to only about 2,000 bbl. daily. There has been a steady increase in reported overages for the past 10 years, but the big gains have been within the past 5 years.

Last year, product output exceeded input by 145,000 bbl. daily which is more than domestic demand for lubricating oils. The upward trend seems to be continuing. For the first 4 months of this year, this overage, or negative shortage, averaged 174,000 bbl. daily.

Demand for each petroleum product is calculated from new supply and stock change. When all demands are added up, the total is refinery output, plus product imports, plus transfers from crude or natural-gasoline plants, plus a small amount of crude exported, and this new supply adjusted for stock changes.

Thus, demand for individual products is calculated from refinery output and product imports in contrast with calculation of total demand which is based on crude and gas-liquids production plus imports.

The left chart shows the increasing spread between all-product demands and demand calculated from primary production and imports. The right chart shows the refinery balance that is back of the difference.

Here is how much difference it makes. On the Bureau of Mines basis, demand increased 45.0% between 1949 and 1960. But, demand for petroleum products increased 47.1%.

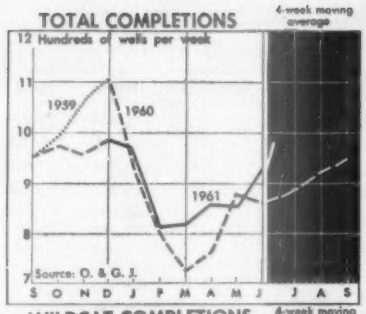
How would YOU like your demand?

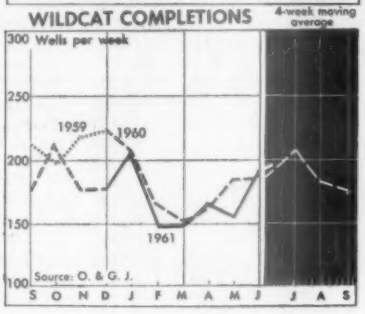
A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,983,570	UP	88,695	UP	122,497
Crude stocks	257,429,000	UP	1,927,000	UP	2,753,000
Completions	933	DOWN	159	UP	29
Refinery runs	7,954,000	UP	165,000	DOWN	326,000
Gasoline stocks	199,557,000	DOWN	618,000	DOWN	1,745,000
Kerosine stocks	29,771,000	DOWN	66,000	UP	1,016,000
Distillate stocks	116,297,000	UP	3,786,000	DOWN	433,000
Residual stocks	48,641,000	UP	1,187,000	UP	5,962,000
Four-product stocks	394,266,000	UP	4,289,000	UP	4,800,000
Total imports	2,283,600	UP	877,300	UP	591,700

Active Rotary Rigs

DRILLING





	7-10-61	7-3-61	7-11-60
Alabama	3	4	3
Alaska	11	11	5
Arkansas	11	12	13
Arizona	1	2	0
California	74	69	84
Land	68	65	79
Offshore	6	4	5
Colorado	26	31	29
Florida	0	0	3
Land	0	0	3
Offshore	0	0	0
Georgia	1	1	0
Illinois	55	51	39
Indiana	11	11	7
Iowa	1	1	0
Kansas	116	110	112
Kentucky	5	5	5
Louisiana	287	287	291
North	38	30	44
S. Inland waters	111	117	111
S. Land	84	82	82
Offshore	54	58	54
Maryland	0	0	1
Michigan	25	18	37
Mississippi	56	62	56
Missouri	3	2	1
Montana	22	24	24
Nebraska	23	34	26

	7-10-61	7-3-61	7-11-60
New Mexico	115	106	102
New York	1	1	0
North Dakota	13	17	17
Ohio	7	7	4
Oklahoma	216	207	167
Pennsylvania	6	7	8
South Dakota	1	1	0
Texas	648	644	566
S. Inland waters	9	10	6
S. Land	192	191	177
Offshore	3	3	1
North	59	61	53
Panhandle	54	48	34
East	63	63	49
West Central	162	164	150
West	106	104	96
Utah	35	27	36
Washington	1	1	0
West Virginia	6	7	4
Wyoming	56	56	70
Total U. S.	1,836	1,816	1,710
Cum. avg. to date	1,662	1,656	1,737
Western Canada	157	170	143
Eastern Canada	1	1	1
Grand total	1,994	1,987	1,854

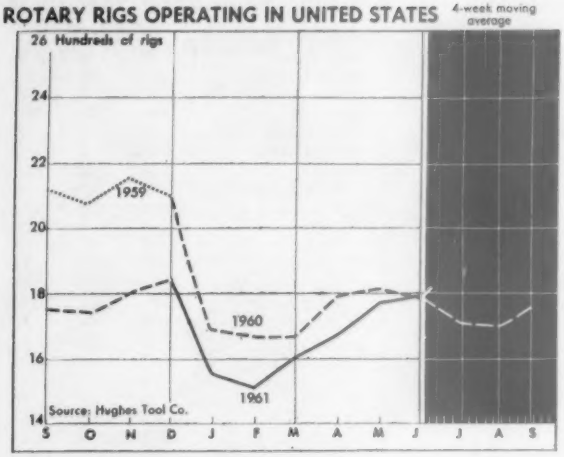
Hughes Tool Co. report.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 8, 1961

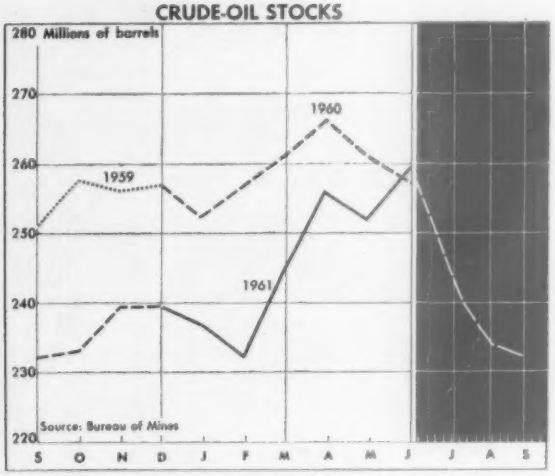
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	1	1	0	0	0	0	11,509	31	27	0	0	0	0	0	7	1
Alaska	0	0	0	0	0	0	0	21	.....	0	0	0	0	0	3	.....
Appalachian	69	17	0	24	17	11	196,955	1,020	887	13	0	0	2	11	46	33
Arizona	0	0	0	0	0	0	0	12	10	0	0	0	0	0	7	10
Arkansas	7	1	0	0	6	0	27,078	260	325	2	0	0	0	2	53	84
California	23	14	0	1	7	1	98,165	834	758	2	0	0	0	2	137	139
Colorado	15	2	0	4	9	0	68,064	315	325	5	0	0	0	5	153	158
Illinois	29	14	0	0	15	0	77,976	909	1,031	10	1	0	0	9	193	230
Indiana	13	3	0	0	10	0	21,335	335	486	5	1	0	0	4	97	186
Kansas	118	55	0	13	35	15	286,633	2,848	1,693	21	3	0	2	16	520	553
Kentucky	24	9	0	0	15	0	25,921	764	832	0	0	0	0	0	78	100
Louisiana	103	52	2	13	36	0	784,984	1,974	1,795	15	1	0	0	14	312	283
North	43	22	2	7	12	0	167,557	737	640	5	1	0	0	4	132	134
South	39	15	0	4	20	0	420,609	927	883	9	0	0	0	9	149	130
Offshore	21	15	0	2	4	0	196,818	310	272	1	0	0	0	1	31	19
Michigan	18	4	0	8	6	0	52,891	360	412	6	0	0	2	4	140	116
Mississippi	12	5	1	0	6	0	120,259	293	373	2	0	0	0	2	94	132
Montana	8	5	0	0	3	0	43,299	188	156	3	0	0	0	3	88	72
Nebraska	21	6	0	0	15	0	93,576	511	422	15	1	0	0	14	237	166
New Mexico	19	2	0	14	3	0	107,476	901	966	1	0	0	0	1	156	149
West	19	2	0	14	3	0	107,476	408	314	1	0	0	0	1	54	35
East	0	0	0	0	0	0	0	493	652	0	0	0	0	0	102	114
North Dakota	12	5	0	0	7	0	72,578	138	157	3	0	0	0	3	35	39
Ohio	13	5	0	3	5	0	33,957	531	522	0	0	0	0	0	23	27
Oklahoma	96	62	1	4	26	3	254,239	3,160	2,040	8	2	0	1	5	326	399
Texas	315	172	7	29	105	2	1,428,579	7,577	8,343	70	10	0	4	56	1,547	1,675
Dist. 1	25	14	0	0	11	0	41,797	472	564	7	1	0	0	6	181	214
Dist. 2	24	7	0	7	10	0	150,151	390	395	6	0	0	2	4	90	98
Dist. 3	47	25	4	2	16	0	261,971	603	642	6	0	0	0	6	116	118
Dist. 4	18	9	0	4	5	0	112,552	654	572	6	0	0	2	4	139	166
East	34	16	0	3	15	0	153,155	665	663	11	2	0	0	9	161	137
Dist. 7-B	27	10	0	4	13	0	89,811	1,016	1,190	5	0	0	0	5	271	335
West	81	48	0	5	28	0	424,323	1,871	2,240	27	6	0	0	21	415	350
Dist. 9	44	33	3	0	6	2	121,689	1,270	1,533	2	1	0	0	1	127	218
Dist. 10	15	10	0	4	1	0	73,130	636	544	0	0	0	0	0	47	39
Utah	5	1	0	0	4	0	31,037	133	137	5	1	0	0	4	59	46
Wyoming	10	7	0	0	3	0	38,997	492	530	1	0	0	0	1	185	215
Misc. (Mo.)	2	0	0	0	2	0	3,209	104	91	2	0	0	0	2	102	75
Total U. S.	933	442	11	113	335	32	3,878,717	23,711	22,318	189	20	0	11	158	4,598	4,888
Previous week	1,092	478	32	104	418	60	4,739,160	.....	.....	234	32	1	4	197	.....	.....
Cum. 1961	23,711	10,709	513	2,338	8,605	1,546	96,080,905	.....	.....	4,598	395	50	208	3,945	.....	.....
Cum. 1960	22,318	10,514	673	1,781	8,716	634	97,377,322	.....	.....	4,888	436	53	160	4,239	.....	.....
Western Canada	78	52	0	14	9	3	406,549	1,113	1,093	13	4	0	4	5	297	297

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-1-61	6-24-61	7-2-60
Pennsylvania	2,406	2,386	2,133
Other Appalachian	1,633	1,676	1,717
Illinois, Indiana, Michigan	10,899	10,944	10,050
Nebraska and North Dakota	3,616	3,441	2,864
Kansas	10,218	9,965	9,670
Oklahoma	16,087	16,186	18,063
Arkansas	2,064	1,911	2,067
Louisiana	22,279	21,036	18,892
North	3,785	3,538	3,244
South	18,494	17,498	15,648
Mississippi, Alabama, Florida	2,305	2,341	2,147
New Mexico	8,443	8,069	8,335
Texas	110,865	108,511	105,770
East Texas	9,172	9,141	8,529
West Texas	49,071	48,186	47,695
Texas Gulf	19,734	19,754	17,893
Other Texas	32,888	31,430	31,653
Wyoming	18,855	19,281	17,851
Other Rocky Mountain	10,227	10,171	10,132
California	24,222	24,408	29,062
Foreign	†13,310	15,176	15,923
Total	**257,429**	255,502	254,676

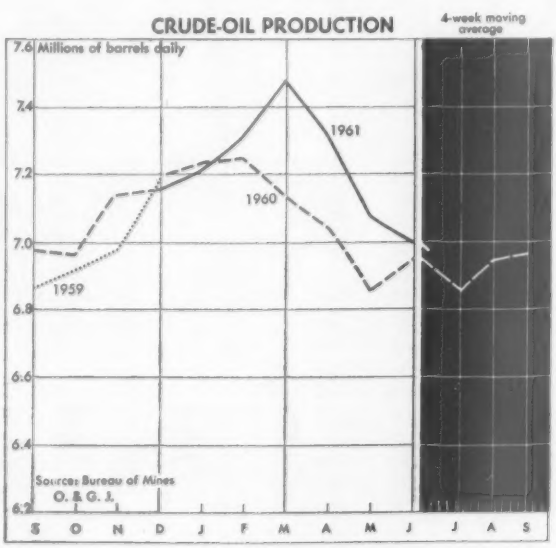
*Bureau of Mines. †Includes 3,085,000 bbl. in California.

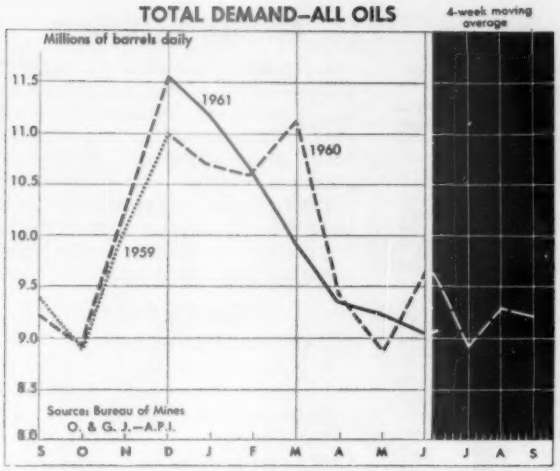
DAILY AVERAGE PRODUCTION FOR WEEK

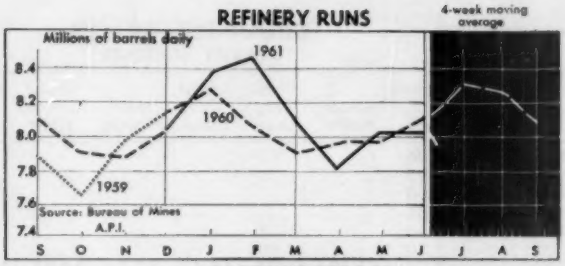
	July 8, 1961			July 1
	Crude oil	Lease condensate	Total	total
Alabama	19,400		19,400	19,350
Alaska	19,100		19,100	19,100
Arkansas	73,600	100	73,700	73,600
California	817,500		817,500	822,500
Colorado	127,300		127,300	127,000
Eastern	40,200		40,200	39,000
Florida	1,000		1,000	1,050
Illinois	211,200		211,200	214,100
Indiana	30,700		30,700	30,700
Kansas	†309,855		†309,855	†307,400
Kentucky	48,700		48,700	48,700
Louisiana	993,225	132,125	1,125,350	1,110,800
North	106,225	5,125	111,350	111,300
South	887,000	127,000	1,014,000	999,500
Michigan	53,800		53,800	49,600
Mississippi	146,900	3,600	150,500	144,900
Montana	90,000		90,000	86,000
Nebraska	68,000		68,000	66,800
Nevada	450		450	450
New Mexico	295,000	7,100	302,100	298,600
North Dakota	57,400		57,400	58,900
Oklahoma	†504,940		†504,940	†487,000
Texas	2,358,000	89,300	2,447,300	2,422,600
Dist. 1	42,000	2,600	44,600	45,300
Dist. 2	97,000	7,800	104,800	107,100
Dist. 3	302,500	37,000	339,500	313,000
Dist. 4	167,500	12,500	180,000	187,500
Dist. 5	27,000	600	27,600	26,500
Dist. 6	102,500	8,000	110,500	114,200
East Texas field	122,500		122,500	128,000
Dist. 7-B	123,000	350	123,350	121,250
Dist. 7-C	111,000	3,150	114,150	113,150
Dist. 8	992,000	12,000	1,004,000	982,000
Dist. 9	166,000	3,500	169,500	179,400
Dist. 10	105,000	1,800	106,800	105,200
Utah	94,000		94,000	77,000
Wyoming	390,400		390,400	389,000
Others	‡675		‡675	‡725
Total U. S.	6,751,345	232,225	**6,983,570**	6,894,875
Change from previous week, up			**88,695**	
Canada	†610,700		†610,700	†602,500
Total U. S. prod.—January 1-July 8				1,364,491,900 bbl.
Same period last year (crude plus cond.)				*1,341,525,900 bbl.

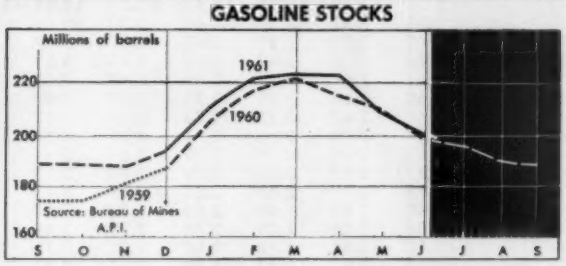
*Includes 43,746,900 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

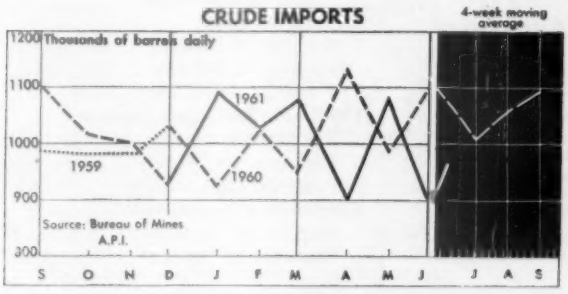
CRUDE-OIL PRODUCTION

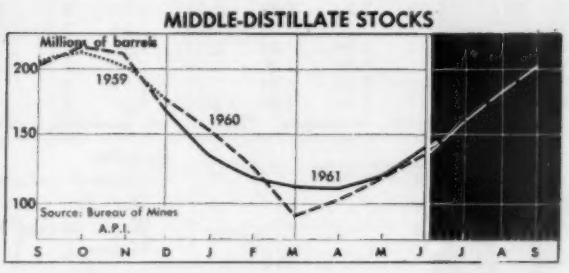


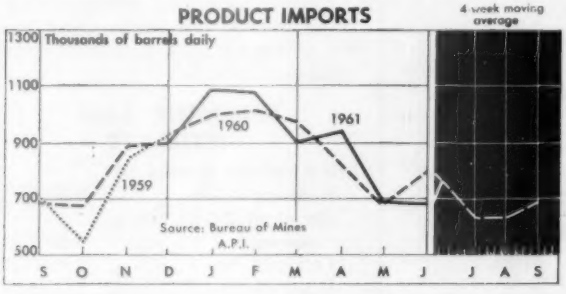


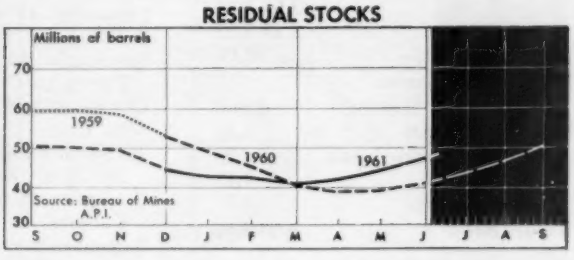












API REFINERY REPORT—JULY 7, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,083	513.4	23.1	322.7	133.0	43,358	10,517	34,947	11,538	1,190	541.5	41.9	350.8	157.3
Appalachian:														
District 1	99	43.3	2.4	25.3	6.9	5,542	616	2,653	456	92	40.5	2.4	20.7	7.1
District 2	104	57.0	1.7	24.8	12.7	2,469	338	1,144	205	108	56.8	2.7	21.1	9.1
Ind., Ill., Ky.	1,466	744.6	72.4	311.1	125.7	34,076	5,224	19,973	5,420	1,448	773.7	72.2	286.2	124.0
Minn., Wis., Dak.	133	60.1	6.0	35.0	18.0	7,266	1,116	4,777	691	127	59.0	4.3	32.5	15.0
Okla., Kans., Mo.	716	434.4	10.0	171.6	11.1	17,259	1,575	10,715	941	739	405.2	14.0	170.2	16.4
Inland Texas	321	214.9	12.1	58.3	18.0	7,339	588	1,568	2,665	309	231.5	7.2	53.4	20.1
Texas Gulf Coast	1,742	862.1	79.7	462.6	116.3	31,007	4,095	16,648	5,757	1,973	1,008.8	112.6	464.7	134.1
La. Gulf Coast	629	353.1	32.3	134.3	39.8	11,415	2,777	5,240	1,336	672	382.9	58.7	147.1	45.0
N. La. and Ark.	108	61.9	2.3	24.3	6.3	5,856	812	1,745	134	107	61.3	5.4	20.4	5.3
Rocky Mountain:														
New Mexico	25	12.0	0.6	4.9	1.9	640	48	226	32	26	13.7	0.3	4.9	2.4
Other Rocky Mt.	289	140.0	5.1	52.0	29.4	7,164	530	2,873	1,006	315	145.6	4.3	65.8	31.6
West Coast	1,239	594.1	37.3	167.4	227.6	26,166	1,535	13,788	18,460	1,201	522.1	34.1	193.6	279.9
July 7, 1961	7,954	4,090.9	285.0	1,794.3	746.7	199,557	29,771	116,297	48,641	8,307	4,242.6	360.1	1,831.4	847.3
June 30, 1961	7,789	3,952.6	291.4	1,735.9	740.7	200,175	29,837	112,511	47,454	.....	.....	.....	.....	.....
July 8, 1960	8,280	4,382.4	383.6	1,864.4	863.7	201,302	28,755	116,730	42,679	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	(†)	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Breckenridge 4.0

Illinois Basin 3.00-3.05

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.085
- Midale C 1.71

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaqin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long Ton)
(Latest reported spot fixtures)

- ★ Gulf-NY, clean (ATRS+10%) $3.14
- ★ Gulf-NY, dirty (ATRS—10%) 2.57
- ★ PG-Japan, dirty (USMC—70%) 3.06
- ★ PG-UK, dirty (Scale—57.5%) (19s. 6d.) 2.73
- ★ Carib.-Montreal, clean (ATRS—43.75%) 2.28

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):
- Regular (91 octane) .. 12.25-12.50
- Premium (99 octane) .. 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.75-11.00
- Regular (92 octane) .. 11.00-11.25
- Premium (98 octane) 12.00-12.25

California (rack) Los Angeles:
- Regular (90 octane) 11.60
- Premium (94 octane) 12.60
- Premium (100 octane) 14.10

Caribbean area (cargoes):
- Regular (87 octane) 9.125
- Premium (97 octane) 11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.50-9.75
- Diesel oil (58 d.i. and above) 9.00-9.25
- Distillate No. 1 ..... 9.00-9.25
- Distillate No. 2 ..... 8.25-8.50

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00
- Distillate No. 2 ..... 8.25

New York Harbor (barges):
- Kerosine 42-43 ..... *11.40
- Distillate No. 2 ..... *10.40
- Diesel fuel, 48-52 d.i. *10.55

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.625

*Subject to 0.5 cent discount.

RESIDUAL FUEL

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.65-1.75

Gulf Coast (cargoes):
- Bunker C fuel 2.20-2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C fuel 2.00

California (rack):
- Bunker C fuel, Los Angeles 2.25

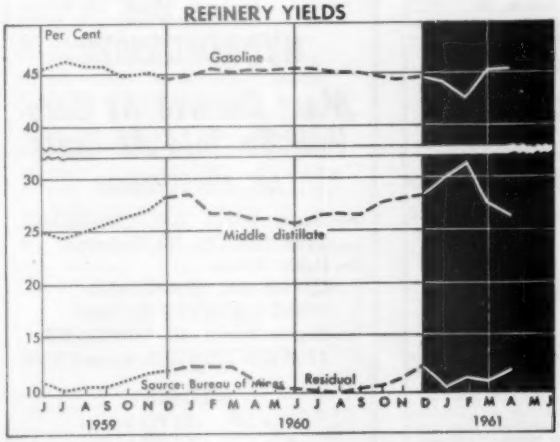
SUPPLY AND DEMAND—PRODUCTS

(Thousands of barrels daily)

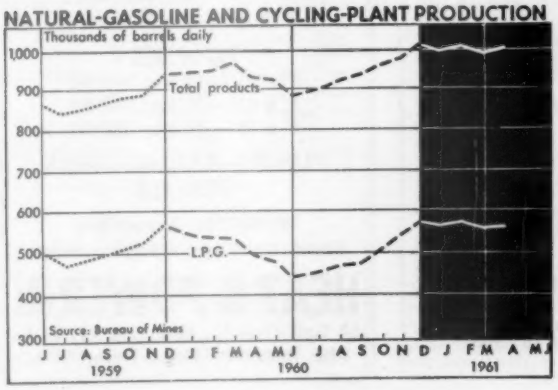
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
June 1961*	4,575	4,110	200,000
May 1961*	4,450	4,090	210,500
April 1961	4,011	3,906	222,524
July 1960	4,418	4,243	196,021
June 1960	4,674	4,160	198,452
KEROSINE			
June 1961*	250	320	30,000
May 1961*	255	285	27,200
April 1961	301	352	27,348
July 1960	261	360	30,499
June 1960	223	325	27,354
DISTILLATE			
June 1961*	1,195	1,760	112,900
May 1961*	1,425	1,725	94,500
April 1961	1,795	1,662	85,003
July 1960	1,156	1,831	131,044
June 1960	1,363	1,778	109,174
RESIDUAL			
June 1961*	1,250	800	47,500
May 1961*	1,365	855	44,700
April 1961	1,578	833	41,848
July 1960	1,216	847	43,848
June 1960	1,377	843	41,074

*Preliminary. †Thousands of barrels.

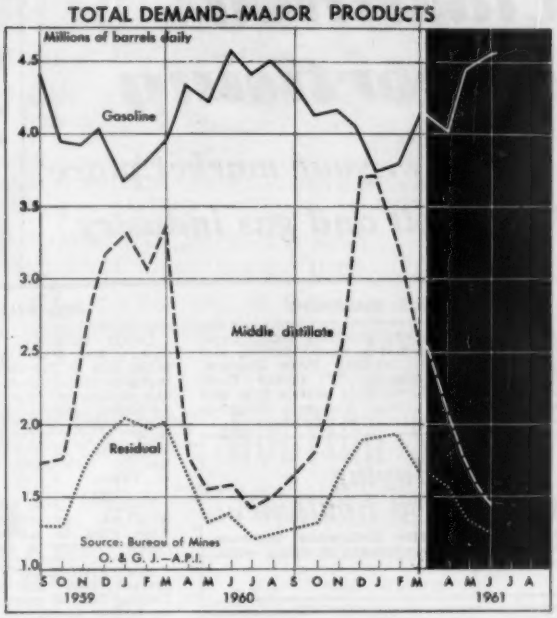
REFINERY YIELDS



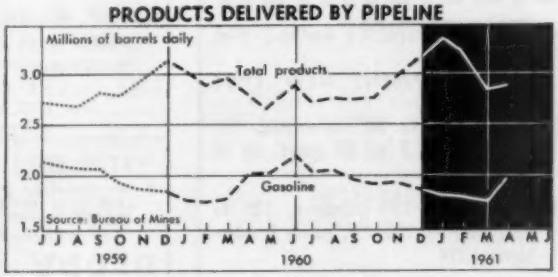
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



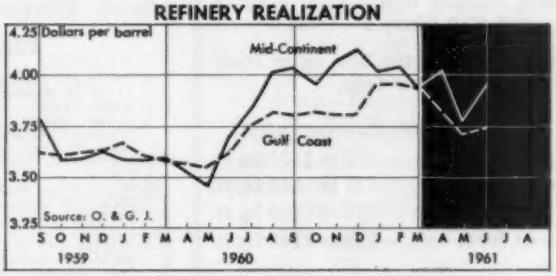
TOTAL DEMAND–MAJOR PRODUCTS



PRODUCTS DELIVERED BY PIPELINE



REFINERY REALIZATION



REFINERY REALIZATION

	June*	May*	Apr.	Mar.
Mid-Continent	$3.94	$3.77	$4.01	$3.94
Gulf Coast	3.74	3.71	3.82	3.94

*Preliminary. Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel and residual as published in The Oil and Gas Journal.

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Boston & Haven St.. Baltimore 24, Md.

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1000HP, 400RPM, 15 x 15, NAT. GAS
5000GPM—640 ft. HD. Pumps, 12UZD-1
REASONABLE PRICE—EL DORADO, ARK.
S. M. DAVIS
Box 1407, E. St. Louis, Ill.

AT N. LITTLE ROCK, ARKANSAS
3—Worthington #LTC-4 compressors. 3500 CFM @ 45 PSI, 24 x 15, 2-cyl. 500 HP, 4-cycle. gas-engine drive.
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1. Franks 658 double drum truck service unit—13 x 10 mast—IHC tandem truck—service 6,500'—12,000' —Powell, Wyoming
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5. Cooper G-149 single drum winch—Allis-Chalmers engine—single pole mast—On Chevrolet truck—Service to 2,500' —Tulsa,Oklahoma
6. Cooper D-14 double drum winch tractor—rubber tired—Power steering—8 x 7 single pole mast—Service to 3,000' —Olney, Illinois
7. Cooper 50' 100,000# stiff derrick— Unmounted—hydraulic raising system—Suitable for tongs —New Iberia, La.
8. Other machines at Houston, Corpus Christi, Tulsa, Montana.
9. Miscellaneous: Wheatley 5 x 10 mud pump and mud tanks, Natchez—Workover pumps Edmonton Canada—Drilling, Tubing and Rod tools.

FRED E. COOPER, INC. P. O. BOX 1890 TULSA, OKLAHOMA—PHONE: LU 2-2194

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FRED E. COOPER deep-hole workover unit, complete with Lee 87' telescoping derrick, 187,000 lb. hook load, hydraulic tongs and air slips. Practically new. One Bucyrus-Erie 48L spudder, complete with rod and tubing tools. Write: G. H. Turpin, 306 Austin, Borger, Texas—or phone: BR 3-5551.

FOR SALE: Perforating Trucks with Logging Equipment. Will Sacrifice! All Offers Considered. Box M-467, The Oil and Gas Journal, Tulsa, Oklahoma.

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Modern 15,000 BSD Fixed Bed HYDROFORMER

Must Remove At Once Will Be Sold As Units Or Piecemeal

3—Steam Driven GAS COMPRESSORS 2495 CFM 205 PSI Discharge
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50,000 ft. 20" No. 1 grade used pipe.
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7'x44'6"x1 1/16" DRUM 255 PSI @ 650°F
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48"x11'x 13/16" DRUM 375 PSI
5'x29'x 7/16" DRUM 100 PSI @ 650°F
5'x17'8"x 5/16" DRUM
25000 CF HORTON SPHERE GAS HOLDER
12' PRESSURE SPHERE 220 PSI @ 850°F
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506GPM @ 311' Pacific 4" Type SVS
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604 Ton Carrier, Freon 11 Refrigeration with Condenser & Cooler driven by 639 HP Terry Condensing Turbine, 430 PSI.

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FOR SALE EQUIPMENT

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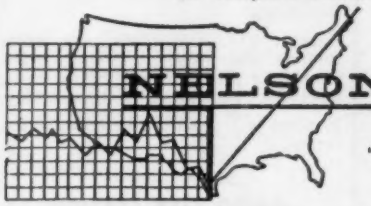

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Practically new Clark TMB-6 Two 8½" 500 lb. cylinders, 26 x 30 Butler ridgid frame building with Crane, located Gardner, Kansas. Rolo Model 52 dehydrator. 20 Rockwell orifice meters with Moran boxes. 3 miles 6", 1 mile 4", 4 miles 2", all 109 Wall, Dresser coupled, miscellaneous valves and fittings, all new.
Contact: **HERB ROSS**
Bedford, Indiana
Phone BRowning 9-2796

SALE OR LEASE:

48L and 36L Bucyrus Erie Spudder,
One Oilwell 66 rotary rig.

KETA GAS & OIL COMPANY
Box 250, Bradford, Pa.

EQUIPMENT WANTED

72 AND 71 Speedstars, 24 Bucyrus Spudders. Also 2⅞" and 2⅜" by 10' and 20' long drill pipe. Will buy outright or trade. Have two rebuilt 1000 Mayhew rotaries and other machines. Star Drilling Supply Co., Phone HE 1-3470, Chanute, Kansas.

We will buy Plants for dismantling. Any size or location.
Let us bid on your next offering for part or complete Plant, Refinery or Equipment.
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STAR WRECKING COMPANY, INC.
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HELP WANTED

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

HELP WANTED

NATURAL GAS Engineer with engineering degree plus 3 to 5 years experince in plant design or operation for work in the Gulf Coast Area. Amerada Petroleum Corp., Gas Department, P. O. Box 2040, Tulsa, Oklahoma.

LARGE INDEPENDENT producing company needs petroleum engineers for drilling and completion, workovers, and secondary recovery operations, in district offices. Positions open in Texas, Louisiana and North Dakota. Should have three to six years experience. Starting salary commensurate with experience and ability. Send complete resume of education and experience and recent photograph to Box 1262, Dallas, Texas.

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Oil Well Chemicals

Graduates with minimum of two years' experience with oil well treating chemicals such as emulsion breakers, paraffin solvents, corrosion inhibitors and water system treating.
Excellent opportunity to grow with newly created department of national oil well service company. Benefits include insurance, retirement, and profit-sharing. Send resume of experience and personal history to: Box M-481, The Oil and Gas Journal, Tulsa, Oklahoma.

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with research technology, organic chemistry technology, practical application engineering, patent, supervisory experience.
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The right man will have a unique opportunity for a rewarding career with a growing company which is making basic contributions in research, engineering, and secondary oil production.

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HELP WANTED

GAS PLANT Superintendent, experienced engineer needed for 375 MMCFD gasoline plant to be constructed in Florida. Successful applicant must have 10 years experience. Engineering degree is preferred. Send resume in confidence to Mr. North, Coastal Transmission Corporation, 520 Bank of Commerce Building, Houston 2, Texas.

PROCESS ENGINEER. Experienced in Petrochemicals, Alkylation, Cat-reforming, Cat-cracking and other refining units. Refinery located in Midwest. Box M-468, The Oil and Gas Journal, Tulsa, Oklahoma.

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Petroleum refinery process engineer with minimum of three years experience. Ability to evaluate raw charge feed stocks and blend finished products. Salary open with excellent fringe benefits. Long established independent refinery located in major center of Louisiana. Our employees know of this ad. Submit complete resume of experience, education and salary requirements. Write:

Box M-482, The Oil and Gas Journal
Tulsa, Oklahoma

PROCESS ENGINEER

Mid-West Refinery has opening for experienced Process Engineer. Must be a graduate engineer, preferably Chemical, and have background in practical and technical aspects of petroleum refining. Here is an opportunity with a growing company. Submit complete resume of experience, education, and salary expected. Reply to:

DERBY REFINING COMPANY
Division of Colorado Oil & Gas Corp.
Attn.: E. R. Jones, V.P. of Manufacturing
P. O. Box 1030, Wichita, Kansas

GULF COAST EXPLORATION MANAGER

Leading Integrated Independent Oil Company looking for Experienced, Aggressive, Imaginative Gulf Coast Exploration Manager. Geologic and Management Experience necessary. Louisiana background desirable. Age 35 to 50 preferred. All replies held in strict confidence.

Send complete resume including salary requirements to:

Box 31 Q 45
The Oil and Gas Journal
4041 Marlton Ave.,
Los Angeles 8, California

HELP WANTED

COMPUTER ENGINEER experienced in petroleum refining economics and capable of directing operations of a computer section. Position is in the Manufacturing Department of a major integrated company located in the Mid-West. Send complete resume to Box M-474, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEERS

The Operating Companies of the Oil Consortium in IRAN have openings for qualified Reservoir Engineers possesing not less than 8 years post-graduate Petroleum Engineering experience, the last 5 of which should have been devoted to specialized reservoir engineering functions.

Salary $13,550-$16,000 net after income tax. Biennial 72 days home vacations plus travel time, housing available, families may accompany.

Replies will be held in confidence, write:

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For medium sized low temperature absorption type gasoline plant located near Houma, Louisiana. Must have experience in plant operations and maintenance. Previous experience as a Superintendent desirable. Send complete resume, including salary expected to:

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Shreveport, Louisiana

SITUATIONS WANTED

GEOLOGIST, 33, B.S., 6 years diversified subsurface experience with major. Speaks Spanish. Interested in domestic or foreign employment. P. O. Box 972, Haines, Oregon.

GEOLOGIST, 30, M.S. Degree, two years experience major oil company in California and Mid-Continent, desires position with smaller concern or consulting group. Resignation result of undersirable relocation along with desire for establishing permanent residence and freedom to make limited oil investments. Resume on request. Box M-488, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER—MANAGER: age 51, family, retired inadequate pension, 21 years foreign service major oil company. Diversified experience: field, refinery construction and maintenance, chief engineer and consultant marketing operations. Knowledge Spanish. Desires position administrative or representative. U. S. or foreign. Box M-484, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST

desires responsible position. Did you discover a new oil field? I am your man to do the subsurface geology, propose new well locations and develop your field. Ten years successful oil experience in VENEZUELA, Colombia, Bolivia and U.S.A. as a subsurface geologist, field geologist, micropaleontologist, well site and consultant in major and small companies. Nine years experience as a practical geologist. Ph. D. I am tough and I like accurate, conscientious work. I speak and write fluently 4 languages. Prefer warm countries and agressive small company. Might also be interested as a partner for joint venture. Box M-349, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PRODUCTION MANAGER—Petroleum Engineer. Experienced in development, production and pressure maintenance operations and unitization negotiation and operation. Registered engineer in California and Canada. Box M-486, The Oil and Gas Journal, Tulsa, Oklahoma.

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MID STATES Oil & Gas Brokers, Phone Ex. 3-7208, Room 7, Chamber Commerce Bldg., Olney, Illinois. Specialies in selling oil and gas properties. List with us for FAST service on Buying or selling oil or gas properties.

LEASE AND DRILLING BLOCKS

WYOMING, NATRONA County 240 acres Federal lease-Sec. 23, T 29N. R 83. Michael Fanakos, Box 73, Villa Grove, Illinois.

AVAILABLE—SMALL interest in producing oil properties in Oklahoma. Write Box 693, Irving, Texas, or call BLackburn 5-1819.

PRODUCING LEASE for sale, 80 acres; needs additional developing. Stephens County, Oklahoma, Box M-487, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL LEASE: 120 acres Chaves County, New Mexico near Roswell. Ronald Menz, 1231 South 30th Street Milwaukee, Wisconsin.

BROWN-Bassett gas field, Block 2, Val Verde County, Texas. Lease 2594 acres $60 bonus. Sale 356.59 acres undivided part of 3042.89 at $100 acre. Larry Payne, 329 S. Harbor Blvd. #85, Santa Ana, California.

SOUTHERN CASEY County, Kentucky: 800 acres in trend east side. Goose Creek fault one mile east and southeast from New Knox oil field. Price $30.00 per acre. Inspection invited. Write—Wire—Phone W. V. Cravens, Russel Springs, Kentucky.

200 ACRES Near Production on Stratton Ridge, Brazoria County, Texas. Brokers invited. Wallace Miller, 2812 Glendale Blvd., Los Angeles 39, Calif. NOrmandy 4-1913.

SOUTHWEST CRANE County, Texas: Oil and gas lease, five years primary term, S/239 acres, section 18, Block B-28, PSL survey, 2 miles from new oil gulf devonian shows in sec. 15, Blk. B-28, PSL, Ward County, Texas. Great potential bargain. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through The Journal's classified advertising pages. You'll be surprised how many are interested.

HAVE 100,000 ACRES of Ohio and West Virginia Oil and Gas Leases in Appalachin Basin Area for immediate sale in the Multa Million acre lease play scattered in and through major companies holdings, specializing in 50 to 60 thousand acre blocks. David Law, 716 Union Trust Building, Parkersburg, West Virginia.

WATER FLOOD PROSPECTS WANTED
Active Oklahoma independent desires to purchase good water flood prospects located anywhere in the Mid-Continent area. Box M-453, The Oil and Gas Journal, Tulsa, Oklahoma.

SOUTH TEXAS AND GULF COAST LEASES WANTED
Active independent desires South Texas and Gulf Coast close in oil and gas drilling prospects. Immediate action on submittal of full information. Box M-452, The Oil and Gas Journal, Tulsa, Oklahoma.

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Production Bought & Sold.
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Turnkey Drilling—Cable or Rotary.
Production Maintenance.
Supervision &
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BRADY & FINDLAY LIMITED
Lease Brokers & General Contractors
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Chatham, Ontario

or phone:
Ralph Brady, Townsend 7-1193
Courtright, Ont.

LEASE AND DRILLING BLOCKS

PROSPECTIVE OIL LEASES: Am fee landowner over 2,000 acres near Pan American Petroleum Corporation No. 1 List, Sec. 23, Block 68, Township 1, T&P Survey, stratigraphic test, projected to 9,500 feet. anticlinal axis nearby, Hudspeth County, Texas, leases available Hudspeth, Crane, Terrell Counties, Texas. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

BUSINESS OPPORTUNITIES

FOR SALE: 100 acre producing waterflood, Box 363 Caney, Kansas.

HIGHEST PRICES paid for producing royalties and overrides. Submit complete details, Jack Antry, 438 Mayo Building, Tulsa, Oklahoma.

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Consultant
National *International*
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Appraisals, Management & Reports
723 Penguin Drive Dallas, Texas

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WE WANT TO BUY MINIMUM 100 BARRELS OIL PRODUCTION PER DAY

Minimum 50,000 barrels remaining primary reserve; complete well history must be furnished together with all available engineering data. Reply Sage Oil Company, 200 Centennial Building, Denver 2, Colo.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 3424.11 acres of land in 18 parcels within the known geologic structure of certain fields in Pittsburg, Major, Woodward, Texas, Harper, Woods, Canadian, Kingfisher and Beckham counties, Oklahoma will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., MST, August 15, 1961, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico, Douglas E. Henriques, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that approximately 309.09 acres of land in four parcels within the known geologic structure of the Rock Creek field, Franklin County, Arkansas, will be offered for competitive oil and gas leasing through sealed bids to the qulaified bidder to the highest cash amount per acre at 1:00 P.M., E.S.T., August 2, 1961, when bids will be opened. Full details of the lease offering, and how and where to submit bids, may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

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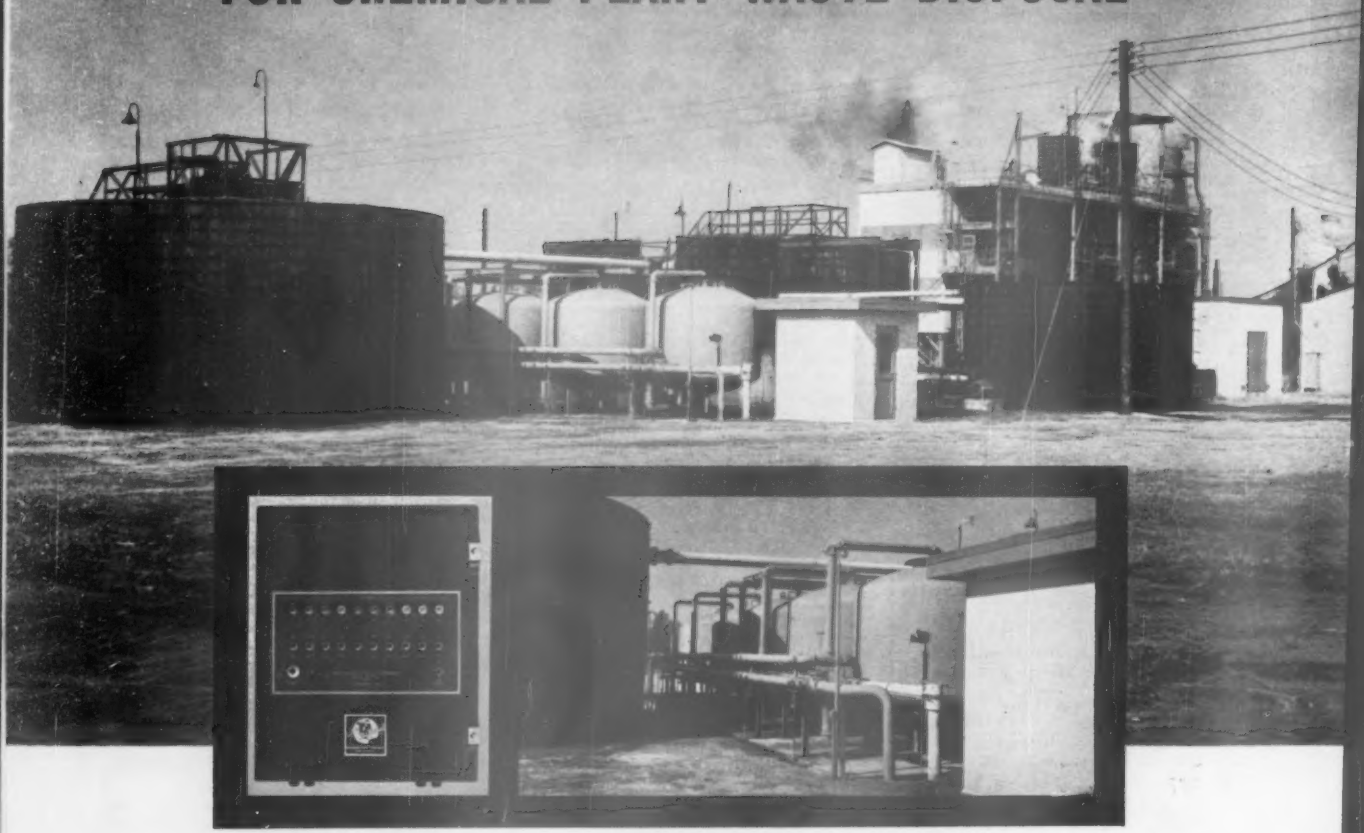

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TULSA, OKLAHOMA

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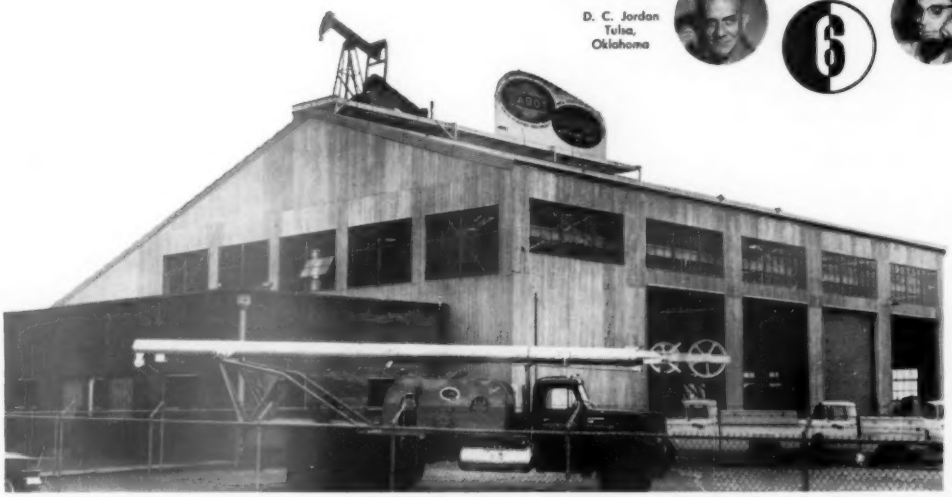

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